

A Taxonomic Revision of the Genus *Neraudia* (Urticaceae)

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INTRODUCTION

THE GENUS *Neraudia* is in the family Urticaceae and is endemic to the Hawaiian Islands. It is found from about 1,600 to 4,000 feet altitude but is seldom represented by more than a few plants in any locality. The lack of a large volume of material, the difficulty of collecting plants of the genus (both conditions resulting from its rarity), and some nomenclatorial confusion have contributed to the lack of understanding of the group. Even now, after the collections and observations of the past 2 years, it is felt that several more years of collection and observation are necessary to furnish sufficient material for evaluating more clearly some of the taxonomic entities included below. Even on the island of Oahu, which has been the most widely explored botanically of any of the Hawaiian Islands, more study of this genus is needed.

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HISTORY OF THE GENUS

The genus *Neraudia* was published by Gaudichaud on March 6, 1830, in the botanical account of his first trip around the world on the "Uranie." He named the genus in honor of M. Néraud, a French lawyer and amateur botanist of Madagascar with whom he became acquainted during his visit to that island. Gaudichaud described and illustrated *Neraudia melastomaefolia* and described *Neraudia ovata* on the basis of material which he collected in the "Sandwich Islands." In 1851 he published a plate illustrating a third species, *Neraudia sericea*, without description, the material for the plate having been collected by Gaudichaud on his second trip, this time on the "La Bonite" voyage. The plate, in

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² The standard symbols proposed by J. Lanjouw (1939-1941) for each herbarium are shown after the name of each institution and these are used in the lists of collections examined to indicate where each collection is deposited.

spite of being rather diagrammatic and lacking accuracy in some details, must nevertheless be accepted as valid publication since it is a "plate with analyses," which, according to the International Rules of Botanical Nomenclature, constitutes valid publication prior to 1908 (Art. 44). In his *Généralités*, published in 1827 and occupying the first part of the volume on the botany of the voyage of the "Uranie," he mentioned three specific epithets. The first, *melastomaefolia*, he retained when he published the genus in 1830, but the second, *pyrifolia*, he evidently changed in favor of the third, *ovata*, before he published the description.

Meyen (1834-1835), in the section of his journal concerning his experiences in the Sandwich Islands, described several new species, one of which was supposedly a new species of *Neraudia*, *N. glabra*. He wrote that the natives called *N. melastomaefolia* "mamaku," which is essentially "mamake," the name now applied to *Pipturus* spp. In his original description and again in 1843, when he transferred his species to the genus *Boehmeria*, Meyen described the leaf margins as crenate. This is particularly significant in that there are no collections of *Neraudia* which show such leaf margins and it is very likely that Meyen did not have a *Neraudia*. For this reason, the name is here excluded (see discussion accompanying *N. melastomaefolia* var. *parvifolia* for more complete explanation). Hooker and Arnott, who studied the plants brought back from the Beechey Voyage, in 1832 transferred the two known species of *Neraudia* to the genus *Boehmeria*, pointing out that in their opinion the two genera were indistinguishable.

Endlicher in 1837 and Steudel in 1841 transferred the described species to *Boehmeria*. Weddell, however, in 1856 accepted the genus and recognized *N. melastomaefolia* and *N. sericea*, giving the latter its first description. *Neraudia ovata* he reduced to β -variety of *N. melastomaefolia*.

Wawra in 1874 accepted *N. melastomaefolia* and *N. sericea* without mention of *N. ovata*.

He described a forma *parvifolia* of *N. sericea* with a question mark. The question mark would seem to indicate either that he was not sure what *N. sericea* was or that he was not sure what rank his entity should have. It seems that he did not know to what the name, *N. sericea*, should be applied as he used it for a group occurring on Kauai (*N. kauaiensis*). The form which he described was later recognized by Hillebrand with a change of status and it is herein accepted. Word has recently been received from the director of the herbarium at Vienna, where Wawra's and Meyen's material was preserved, that the section of the herbarium including the Urticaceae was destroyed by fire during the recent war, so it is unlikely that their material will ever be available for study. Furthermore, in 1935 neither St. John nor the director of the herbarium was able to find the specimen which Wawra had used as a basis for his forma *parvifolia*.

Bentham and Hooker in 1880 accepted the genus and remarked simply that two or three groups occurred in the Sandwich Islands.

Hillebrand in 1888 accepted Gaudichaud's *N. melastomaefolia* listing *N. ovata*, *N. glabra*, *Boehmeria melastomaefolia*, and *B. glabra* as synonyms. The name *Neraudia sericea*, he used incorrectly, applying it to a variety of *N. melastomaefolia*. He then described a new variety of *N. melastomaefolia*, var. *Kauaiensis*, and transferred Wawra's forma *parvifolia* of *N. sericea* to *N. melastomaefolia*, raising it to varietal status. On the basis of a scrap of material collected by John Lydgate on the island of Kahoolawe, and of which no one has seen material since, he described a new species, *Neraudia Kahoolawensis*. Engler in 1893 accepted the genus noting "2-3 Arten auf den Sandwich-Inseln."

In 1944 Skottsberg described forma *truncata* of *N. melastomaefolia* based on *Selling* 3363 from the Waianae Range of Oahu. This name is treated here as a synonym of *N. melastomaefolia* var. *parvifolia*.

In the taxonomic portion of this paper I have attempted to discover what the older concepts were and how the names were applied by studying available plates, descriptions, and the types of some of the groups.

RELATIONSHIPS OF THE GENUS NERAUDIA

Taxonomists differ in their interpretation of the family Urticaceae but even if it is divided into four families, as is done by many workers, *Neraudia* is still most logically assigned to the segregate family Urticaceae. As may be seen in Table 1, *Neraudia* shows some of the characters which have been used to separate two of these families. To summarize the table: the genus shows two characters overlapping between the two families; three features in common with the Urticaceae; one feature characteristic of the Moraceae. The presence of this overlapping would seem to indicate that the lines separating the families are not particularly well-defined. The use of the milky sap character in the segregation is not worthy of the importance attached to it by some workers. Possibly the aggregate interpretation of the family with several tribes would be a more logical and valid one than that of several rather weakly delimited families.

To determine which genus of the Urticaceae *Neraudia* most closely approaches morphologically (in an attempt to establish relationships) I have made a relatively complete review of the treatment of the family by Weddell (1856–1857). In his key to the genera of the "Boehmerieae," *Neraudia* is placed in a group with

Cypholophus, *Sarcochlamys*, *Touchardia*, and *Laurea*. Of these, *Cypholophus* seems to be the genus most similar to *Neraudia*. In *Cypholophus* a fleshy perigone develops at maturity but it invests the achene very closely, whereas the achenes of *Neraudia* are completely free, with considerable space between them and their perigones. The flowers of *Cypholophus* are borne in dense heads as contrasted to the very loose groups of individual flowers of *Neraudia*. I find that *Neraudia* (in Weddell's treatment) shows the greatest morphological similarity to a genus of the preceding section of the key, the genus *Pouzolsia*, rather than to any of those in the previously mentioned section. This is a large genus distributed throughout the tropics with nine species in the Indian area and three from the East Indies. Table 2 presents some of the similarities and dissimilarities between these two genera. A definite statement of the relationships of these genera cannot be made until material of *Pouzolsia* from the many localities where it occurs has been examined critically; it does seem, however, that there is rather close relationship between the two.

There is also considerable similarity in general habit, floral structure, leaf characters, and type of fruit in *Neraudia*, *Pipturus*, and *Boehmeria*, but the first is separable from the others by the accrescent, fleshy calyx which surrounds the achene when it is mature. The achenes of *Pipturus*, surrounded by the dried and shriveled calices, are imbedded in a white, insipid, fleshy mass in the leaf axils.

TABLE 1

RELATIONSHIPS OF *Neraudia* TO THE SEGREGATE FAMILIES MORACEAE AND URTICACEAE.

CHARACTER	URTICACEAE	MORACEAE	NERAUDIA
Sap	Watery	Milky	Milky
Phyllotaxy	Alternate or opposite	Alternate	Alternate
Fruit	Achene	Aggregate or multiple	Achene
Stamens	Folded inward	Folded inward or straight	Folded inward
Ovule	Erect	Pendulous	Erect
Embryo	Straight	Curved or spiral	Straight

DISTRIBUTION OF SPECIES AND VARIETIES

Neraudia, which is restricted to the Hawaiian Islands, is represented on most of the major islands—Kauai, Oahu, Maui, Molokai, Lanai, and Hawaii. With only one exception, the groups are restricted to one island or to one particular part of an island. The exception is *N. sericea*, which occurs on Maui, Lanai, and Molokai. The varieties of *N. melastomaefolia* occur on three islands, variety *pubescens* on Kauai, variety *pallida* on Maui, and the other four varieties on Oahu.

In the Waianae Range of Oahu a greater number of groups is found than in any other island locality, for in this region grow varieties *melastomaefolia* and *parvifolia* of *N. melastomaefolia* and both varieties of *N. angulata*. In the Koolau Range of Oahu are found two of the varieties of *N. melastomaefolia*—*uncinata* and *Gaudichaudii*. An examination of the "total number of groups per island" in Table 3 shows that the number of groups per island decreases progressively to the south and to the north of Oahu. From this observation it is postulated that the island of Oahu received the ancestral form which has given rise to the groups of this genus. Certainly the number of groups on Oahu

would indicate a considerable period of active speciation during which time propagules have been transported to most of the other islands with subsequent modification of the introductions.

Altitudinally, members of the genus range from 1,600 to 4,000 feet. They are found in extremely dry to wet situations. Most of the groups are collected in moist regions but *N. ovata* grows in very dry soil or in rough lava fields. *N. sericea* also has been collected (as far as can be determined from scanty data) in the lower xerophytic forests growing in dry soil or in lavic regions.

TAXONOMIC CHARACTERS USED IN CLASSIFICATION

As in the floras of most regions, in the Hawaiian flora are a number of genera the species of which have been shown to evidence extreme variability. Much of the variation in a population is undoubtedly due to genetical differences but a certain proportion must be due to the complex series of micro-climates which are characteristic of the Hawaiian Islands. Because of this variability it becomes difficult to arrive at characters which will delimit the populations.

TABLE 2
A COMPARATIVE ANALYSIS OF THE GENERA *Neraudia* AND *Pouzolsia*.

CHARACTER	NERAUDIA	POUZOLSIA
Sex condition of flowers	Dioecious	Monoecious, rarely dioecious
Flower arrangement	Axillary, unisexual clusters	Axillary heads, spikes, or cymes; sexes mixed in same inflorescence
Staminate calyx	4-parted	3-4-5-parted
Stamens	Four	Three to five
Apex of perigone	0-4 toothed	2-4 toothed
Ovule	Erect	Erect
Pistillate calyx	Fleshy, free from achene	Greatly enlarged or scarcely changed
Habit	Shrub or small tree	Trees, shrubs, or herbs
Leaf arrangement	Alternate	Alternate or opposite
Leaf margin	Undulate, dentate, or entire	Dentate or entire
Venation of leaves	3-nerved	3-nerved
Cystoliths	Disciform	Disciform

Neraudia has been a problem of this sort and it is apparent that instead of very precise, definite, constant characters which operate throughout the genus, there is a tendency for differences to be expressed in sets of characters. Furthermore, a character which is constant in one group may prove to be quite variable in another. Each population is influenced by its own set of environmental factors and each has its own particular genetical makeup. These two sets of factors alone are enough to insure that the degree of variability and the organ affected may be quite different in each population.

Leaf shape has been used to distinguish some of the groups in this genus and is occasionally a usable character since some of the groups show tendencies toward particular leaf shapes. However, in most of the groups leaf shape exhibits so much variability that it is not satisfactory as a key character. In some groups ovate to elliptic leaves with intermediate shapes occur in the same collection; in such groups, at least, leaf shape is an unreliable character. Leaf size is expected to show some variation in all genera but in this genus the extremes of lengths and widths are often great in the same group. The shape of the base and of the apex of the leaves is often more constant but this is not a completely reliable key character either.

Vesture of the leaves has proved the most reliable character in the genus and is, I believe, genetical in nature. Even the quantity of pubescence present seems to be relatively constant; but it is the type of hair, distribution, posture, and orientation of the hairs that are used as key characters. The hairs are always simple but may be short and uncinata, longer and arcuate, curving and bending irregularly, or straight. In some groups the lower leaf surface is glabrous or sub-glabrous; in others the pubescence is restricted to the venation but in most groups this is not so. The pubescence on the upper leaf surface is always of the same type as that below but is more sparse and usually appressed. The consistency of the leaves varies somewhat, insofar as it has been possible to observe it in fresh and dried collections, but it is constant enough to be used in identifying some groups.

The venation of the leaves is of two general types and on this basis the genus is separable into two parts. If a leaf is held against a strong light the fine details of the venation are clearly discernible with or without magnification. Because of the prominence of the secondary vein branches the first type appears to be a coarse-meshed net within the intervals of the primary vein branches, whereas the second type, due to the equal or greater prominence of the tertiary

TABLE 3
DISTRIBUTION OF SPECIES AND VARIETIES OF *Neraudia*.

	KAUAI	OAHU	MAUI	LANAI	MOLOKAI	HAWAII
<i>N. melastomaefolia</i>						
var. <i>melastomaefolia</i>.....	..	x	..	..	..	..
var. <i>uncinata</i>.....	..	x	..	..	..	..
var. <i>Gaudichaudii</i>.....	..	x	..	..	..	..
var. <i>pubescens</i>	x	..	..	..	..	..
var. <i>parvifolia</i>.....	..	x	..	..	..	..
var. <i>pallida</i>.....	..	..	x	..	..	..
<i>N. angulata</i>						
var. <i>angulata</i>.....	..	x	..	..	..	..
var. <i>dentata</i>.....	..	x	..	..	..	..
<i>N. kauaiensis</i>						
var. <i>kauaiensis</i>	x	..	..	..	..	..
var. <i>Helleri</i>	x	..	..	..	..	..
<i>N. ovata</i>.....	..	..	..	..	..	x
<i>N. sericea</i>.....	..	..	x	x	x	..
Total number of groups per island.....	3	6	2	1	1	1

branching gives the impression of a very fine-meshed net. The principal veins and their first branches may be strongly salient or only slightly raised. The leaves may be either palmately nerved or triplinerved and this character is of some use in distinguishing certain groups.

The flowers are of two sexes borne on separate plants. Flowers of either sex may be sessile or short-pedicelled but are constantly either one or the other. The calyx of all pistillate flowers is fused so that the ovary is loosely enclosed in the inflated calyx. The tip of this perigynium is always elongated into a beak through which the style passes. The stigma is filiform and covered more or less completely with stout stigmatic hairs which serve as receptive surfaces for the pollen. The pubescence on the exterior surface of the calyx is ordinarily of the same type and posture as that found on the lower leaf surface. After fertilization of the single, erect, basally attached ovule the ovary undergoes certain characteristic changes in form and becomes hard and bony. More striking though is the change in the calyx, which enlarges to many times its original size, becomes fleshy, and turns red at maturity. It is variable in shape and ranges in size from 3 or 4 millimeters to as much as a centimeter or more in height.

The achene characters are used to distinguish species and groups of subspecific rank. The dimensions and shape of the basal and apical portions of the achenes are usable characters but only if completely mature forms are available. The apical portion may be conic or depressed-conic and may be separated from the basal portion incompletely or completely by a deep or only slight constriction. The basal portion may be flattened or convex and its outer margin may be involute or plane.

The staminate flowers and pistillate flowers may be borne on pedicels. When they are so borne the pedicels are slender-filiform but because of their shortness (0.5–2.0 mm.) are most easily observed at nodes where flowers and fruits have been shed. Occasionally the scars of fallen sessile flowers become somewhat

swollen but differ from pedicels in their greater thickness and shortness.

The calyx of the staminate flowers consists of four navicular lobes which separate at maturity to release the four, opposite, inflexed stamens. The filaments are folded inward so that the connective is nearest the center of the flower. At maturity the filaments, when released by the opening of the calyx segments, snap outward explosively and at the same time the pollen is discharged in a small white cloud. From this method of pollen discharge and the presence of the feathery stigma described above, it may be safely postulated that the pollination agent is the wind since both of these mechanisms are adaptations for wind pollination. The staminate flowers have few distinctive characters other than different types of hair on the calyx and the consistency of the lobes.

TAXONOMIC CATEGORIES

Of all biological terms "species" is undoubtedly one of the most difficult to define in a manner which is satisfactory and acceptable to even a small group of taxonomists. The concept itself is reasonably clear but the problem of its definition must still be resolved by the individual worker. Each must decide what his basic criteria for the recognition of a species shall be and then attempt to apply his concept in the field as well as in the laboratory. Experience and contacts with other taxonomists will usually force certain modifications of the original concept so that the ultimate interpretation may be quite unlike that originally held. In this paper a species is interpreted as a population of individuals showing constant morphological differences distinct from those of other populations in the genus.

Varieties are considered to be units within the main specific population which show a character or characters peculiar to themselves but these differences are often overlapping to some degree, i. e., varieties lack the distinctness which characterizes the specific unit. The varietal category has not been used to replace

that of the subspecies nor is the category in any way related to the horticultural usage of the term. Some workers have advocated the abolition of the term "variety" and have used the argument that there is confusion in its usage in formal taxonomy and in horticulture. However, it is a category sanctioned in the International Rules and the "confusion" is mostly in the minds of the workers who advocate abolishing the term. A variety may arise by hybridization where two populations meet geographically, or it may be produced as a result of population changes induced by geologic or climatic isolation, although the origin in either manner may be obscured by the disappearance of intermediate forms. In general, it is assumed that varieties are incipient species.

Although subspecies and forms have not been recognized in the study of this group, it seems advisable to attempt a definition of them. The subspecies category seems to be applied best to groups of varieties with less than specific distinctness but more distinctness than a variety. Forms are taxonomic units (within either the specific or varietal population) which exhibit morphological differences of less significance than those shown by a varietal, subspecific, or specific group. Such entities appear sporadically within populations of higher categories. The difficulty lies in the recognition of forms, for unless extreme care is exercised each ecad may receive recognition as a form and be named and described as such. Forms are considered varieties in the embryonic state of differentiation.

SYSTEMATIC AND DESCRIPTIVE TREATMENT

Genus *NERAUDIA* Gaudichaud

Neraudia Gaudichaud, Freyc. Voy. Uranie
Bot.: 500, 1830.

Erect, climbing, spreading, or vining shrubs or small trees with watery-milky or very milky sap; branches usually arcuate but sometimes erect and straight, branchlets green with pinkish tint at growing tip, pubescence very sparse to abundant, hairs erect or appressed, grayish or

whitish or almost hyaline; petioles 0.5–6 cm. long, terete, sparsely or abundantly pubescent, hairs erect or appressed, straight or irregularly bending and curving. Leaf blades 3–19.5 cm. long, 1.5–7 cm. wide, elliptic, lanceolate, oblance-elliptic, elliptic-ovate, ovate, slightly obovate, or oval, thin or membranous to thick-coriaceous, palmate or triplinerved; upper surface glabrous or with few to many erect or appressed hairs, cystoliths disciform, even with upper leaf surface, pulvinate, or strongly salient with rounded or sharply truncate apex (in dried material), lower surface glabrous or with few hairs largely restricted to venation, or with many erect or appressed hairs over entire lower surface, or with dense covering of erect to suberect, irregularly curving and bending hairs, or puberulent; principal veins and primary branches of veins slightly or strongly salient, margin entire, dentate, repand, or irregularly undulate; base cuneate, cuneate-decurrent, obtuse, or sub-cordate, apex abruptly acute to long-acuminate or tapering gradually into an acute or long-acuminate tip. Pistillate flowers sessile or on pedicels 0.5–2 mm. long, some flowers with subtending bract, calyx lobes fused into perigynium with tip drawn out into beak, perigynium pilosulose with few, ascending, appressed hairs or many erect hairs, beak flaring or narrowing upward, irregularly lacinate to four acute-toothed, to four acuminate-toothed, to three-toothed collariform, stigma 2–8 mm. long, receptive stigmatic hairs on all surfaces or one side lacking stigmatic hairs. Achene enclosed in accrescent, thin to thick-fleshy, smooth, or sharply angled and ridged calyx, achene 1–3.5 mm. tall, usually with distinct apical and basal portions, apical portion conic, depressed-conic, hemispheric, separated from basal portion by deep acute constriction or by very shallow or slight constriction or without definite, complete constriction, basal portion flat, depressed-convex, or convex, outer margin plane or involute, seed ellipsoid or ovoid, constricted in upper part or entire. Staminate flowers sessile or on pedicels 0.5–2.5 mm. long, four calyx segments cohering

in bud but separating at maturity, thin to thick, navicular, pilosulose, hairs appressed or erect, few to many, hairs straight or uncinat, 2-6 mm. long, 1-2 mm. wide, filaments 2-5 mm. long, folded inward in bud, strap-shaped, anthers two-celled, reniform, each sac 0.8-2 mm. long, 0.5-1 mm. wide.

KEYS TO THE SPECIES AND VARIETIES OF
NERAUDIA

Instructions for Use of Keys

As collected, plants of this genus may be sterile, may have staminate flowers or pistillate flowers, may lack fruit, or may have both pistillate flowers and fruit. Because of this variety, keys which are intended to identify plants collected in any condition have been constructed. There undoubtedly will be collections which may prove troublesome but it is felt that the keys, if carefully used, will identify collections of the groups recognized. The heading of each key indicates the type of collection for which the key was constructed. In all cases the characters used in the keys apply to mature, dried, normally developed structures and it is important to recall this when attempting to use the keys. For example, the achene characters which are important appear sometimes only in the completely mature achenes.

In this study a dissecting microscope has been used and those who use the keys must do likewise. The necessary magnifications for studying pubescence and flowers in this genus are about 36-72X, whereas pedicels or achene details can best be observed with about 12X magnification. The details of the reticulation of the leaves have been used in the keys; the reticulation is most readily and accurately observed by holding a leaf against a strong light source, with or without magnification.

The length of the hairs has been referred to in some places as "short" or "long": the term "long" refers to hairs of about 1-2 mm. or longer; the term "short" refers to those considerably less than 1 mm. long.

The first key is based upon typical, full-

flowering material and should be used in attempting to identify such material only. Collections in the vegetative state or in a state of transition between vegetative activity and flowering should be identified by Key II.

Glossary of Terms Employed

Basal portion—applied to the lower expanded portion of the achene.

Depressed-conic—applied to the apical portion of some of the achenes which appear to have been depressed apically so that the sides are rounded and bulging.

Interval—the portion of a leaf blade enclosed by any degree of branching of the venation, e. g., a primary interval is that part of the leaf blade within a part of the primary branching.

Perigynium—the calyx of the pistillate flower fused into a bladder which surrounds the ovary.

Pilosulose—pilose, but with the hairs short.

Primary branches—first degree of branching of the principal veins.

Principal veins—midrib and two equally strong laterals.

Puberulent—covered with fine and short, almost imperceptible down.

Sericeous—covered with many shining, silky, appressed or sub-erect, straight hairs.

Triplinerved—principal veins diverging any distance above the leaf base.

KEY I

General Key to Species and Varieties of *Neraudia*

- 1. Lower leaf surface glabrous, sub-glabrous with only few hairs largely restricted to venation, or with long, evenly distributed, appressed or sub-appressed hairs. 2
- Lower leaf surface evenly puberulent, sericeous, or pilosulose with more or less dense cover of irregularly curving and bending hairs 7
- 2 (1). Flowers of one or both sexes all, or at least some, pedicelled; pedicels 0.5-2 mm. long. 3
- Flowers of both sexes sessile. 5

- 3 (2). Lower leaf surface with many rather long, evenly distributed hairs. Uncinate hairs lacking on all plant parts.....N. *melastomaefolia* var. *Gaudichaudii*
- Lower leaf surface with few or no hairs except on veins; if present, in intervals and very short; uncinata hairs present on leaves and calices 4
- 4 (3). Leaves and calyx lobes coarse, thick; venation on lower leaf surface markedly salient; leaves usually triplinerved. Apical portion of achene depressed-conic, basal portion thickened. Calyx of staminate flowers with about equal proportion of straight appressed and shorter, erect, uncinata hairs.....N. *melastomaefolia* var. *melastomaefolia*
- Leaves and calyx neither coarse nor thick; venation on lower leaf surface not very salient; leaves usually palmately nerved. Apical portion of achene usually conic, basal portion thin, often flat. Calyx of staminate flowers with all or most of the hairs short, erect, uncinata.....
...N. *melastomaefolia* var. *parvifolia*
- 5 (2). Pubescence on lower leaf surface largely restricted to venation, primary intervals without long hairs. Outer margin of achene not involute..... 6
- Pubescence on lower leaf surface not restricted to venation, primary intervals with many long, appressed or sub-erect hairs distributed over entire surface. Outer margin of achene involute.....
...N. *melastomaefolia* var. *pubescens*
- 6 (5). Secondary veins and smaller vein branches of lower leaf surface with many short, erect or sub-erect, uncinata hairs; lower leaf surface paler but not markedly pallid when dry.....
...N. *melastomaefolia* var. *uncinata*
- Venation of lower leaf surface not as above, glabrous or sparsely pilosulose with few ascending, appressed hairs; lower leaf surface very pallid when dry.....
...N. *melastomaefolia* var. *pallida*
- 7 (1). Lower leaf surface white- or whitish-sericeous, usually conspicuously viscid. Calyx of pistillate flowers distinctly angled, that enclosing mature achene thick-fleshy and with many fleshy ridges and angles 8
- Lower leaf surface pilosulose with hairs irregularly curving and bending or lower leaf surface puberulent 9
- 8 (7). Leaf margin always entire, pubescence on lower leaf surface appressed, oriented centripetally in primary intervals, mostly directed toward margin and producing a geometrically uneven sheen....
.....N. *angulata* var. *angulata*
- Leaf margin completely dentate, partly dentate, or rarely entire; pubescence on lower leaf surface mostly erect or sub-erect but upper part of each hair somewhat arcuate, pubescence oriented much as in var. *angulata* but geometrically uneven sheen not marked
.....N. *angulata* var. *dentata*
- 9 (7). Lower leaf surface puberulent. Outer margin of achene involuteN. *ovata*
- Lower leaf surface with more or less dense cover of grayish pubescence, hairs irregularly curving and bending or almost straight. Outer margin of achene not involute 10
- 10 (9). Leaf margin entire 11
- Leaf margin irregularly undulate (only staminate flowers known)N. *kauaiensis* var. *Helleri*
- 11 (10). Apical portion of achene conic without deep constriction separating it from basal portion. Leaf base usually sub-cordate; secondary branching of veins forming the conspicuous reticulation in primary intervals
.....N. *kauaiensis* var. *kauaiensis*

Apical portion of achene depressed-conic with deep constriction separating it from basal portion. Leaf base usually cuneate; tertiary branching of veins forming the conspicuous reticulation in primary intervals *N. sericea*

KEY II

For Identification of Non-fruiting Pistillate or Sterile Plants

- 1. Secondary branching of veins forming conspicuous reticulation of leaf, that formed by the tertiary branching less conspicuous or obscure, giving the impression of a coarse-meshed net within the primary intervals 2
 - Tertiary branching of veins forming the conspicuous reticulation of leaf, that formed by the secondary branching not more conspicuous and often less conspicuous than that formed by the tertiary branching, giving the impression of a fine-meshed net within primary intervals 14
- 2 (1). Calyx of pistillate flower angled. Lower leaf surface sericeous . . . 3
 - Calyx of pistillate flower not angled. Lower leaf surface not sericeous . . . 4
- 3 (2). Leaf margin dentate, partly dentate, or rarely entire. Pubescence on lower leaf surface mostly sub-erect except that upper part of each hair is somewhat arcuate *N. angulata* var. *dentata*
 - Leaf margin always entire. Pubescence mostly appressed and directed toward margin, oriented centripetally in primary intervals producing a conspicuous geometrically uneven sheen *N. angulata* var. *angulata*
- 4 (2). Calyx beak attenuate apically. Lower leaf surface not obscured by pubescence (or if partly or completely obscured, leaf base sub-cordate or leaf margin irregularly undulate) 5
 - Calyx beak expanded apically. Lower leaf surface obscured by pubescence (if not, or only in-

- completely obscured, lower surface puberulent or lower surface markedly pallid when dry) 13
- 5 (4). Lower leaf surface with little or no pubescence; when present, hairs largely restricted to principal veins and primary vein branches; infrequently very short hairs in vein intervals 6
 - Lower leaf surface generally pubescent, hairs not restricted to veins but generally distributed over entire surface 9
- 6 (5). Flowers all, or at least some, pedicelled; pedicels slender, 0.5-2 mm. long, often persistent on sterile plants recently fertile . . . 7
 - Flowers all sessile 8
- 7 (6). Leaves thin, palmate; apex abruptly acute to acuminate; base often obtuse or sub-obtuse. Calyx lobes thin *N. melastomaeifolia* var. *parvifolia*
 - Leaves thick, usually triplinerved; apex evenly acute to acuminate; base usually cuneate. Calyx lobes thickish, particularly at tips. . *N. melastomaeifolia* var. *melastomaeifolia*
- 8 (6). Lower leaf surface with few to many erect or sub-erect, very short, uncinete hairs on venation other than principal veins and primary branches; paler below when dry but not markedly pallid. Leaf apex evenly acuminate . . . *N. melastomaeifolia* var. *uncinata*
 - Lower leaf surface without uncinete hairs, entirely glabrous or with few, appressed hairs on principal veins; when dry, markedly pallid below. Leaf apex usually abruptly acuminate *N. melastomaeifolia* var. *pallida*
- 9 (5). Leaves with dense covering of irregularly curving and bending, erect hairs on lower leaf surface, or hairs almost straight 10
 - Leaves without above type of pubescence but with few to many long, evenly distributed, ascending, appressed or sub-erect hairs 12

- 10 (9). Leaf margin entire 11
 Leaf margin irregularly undulate
 (only staminate plant known) . .
 *N. kauaiensis* var. *Helleri*
- 11 (10). Leaf base usually rotund, sub-
 cordate or obtuse. On upper leaf
 surface at junction of principal
 veins, tuft of hair always erect.
 On veins of lower leaf surface,
 hairs erect, irregularly bending,
 or almost straight
 *N. kauaiensis* var. *kauaiensis*
- Leaf base not rotund or sub-cordate,
 usually cuneate. On upper leaf
 surface at junction of principal
 veins, tuft of hair appressed. On
 veins of lower leaf surface, hairs
 ascending, mostly appressed, and
 nearly straight *N. sericea*
- 12 (9). Leaves usually palmately nerved. .
 . . *N. melastomaefolia* var. *pubescens*
- Leaves usually triplinerved *N.*
melastomaefolia var. *Gaudichaudii*
- 13 (4). Leaves elliptic or oblance-elliptic,
 entirely glabrous or with few as-
 cending, appressed hairs on mid-
 rib of lower leaf surface; when
 dry, lower leaf surface markedly
 pallid
 *N. melastomaefolia* var. *pallida*
- Leaves not as above, with dense
 covering of erect, irregularly
 curving and bending hairs on
 lower leaf surface. *N. sericea*
- 14 (1). Lower leaf surface puberulent, hairs
 very short, and fine, almost
 hyaline *N. ovata*
- Lower leaf surface densely pilosulose,
 hairs whitish or grayish and
 longer (more than 0.8 mm.)
 *N. sericea*

- 3 (2). Leaf margin dentate, partly dentate,
 or, rarely, entire. Pubescence on
 lower leaf surface sub-erect, hairs
 mostly arcuate in upper part, di-
 rected mostly toward margin,
 geometrically uneven sheen on
 lower surface not marked
 *N. angulata* var. *dentata*
- Leaf margin always entire. Pubes-
 cence on lower leaf surface
 strictly or mostly appressed and
 oriented centripetally in primary
 intervals and producing a marked
 geometrically uneven silvery
 sheen . . . *N. angulata* var. *angulata*
- 4 (2). Outer margin of basal portion of
 achene not involute 5
 Outer margin of basal portion of
 achene involute 11
- 5 (4). Apical portion of achene de-
 pressed-conic or hemispheric . . . 6
 Apical portion of achene not de-
 pressed-conic or hemispheric but
 more or less conic with blunt or
 sharp tip 10
- 6 (5). Apical portion separated from
 basal portion by deep transverse
 constriction. Lower leaf surface
 densely pilosulose, hairs erect, ir-
 regularly curving and bending . .
 *N. sericea*
- Apical portion separated by only
 slight, obtuse constriction from
 basal portion or lacking definite,
 complete constriction. Lower leaf
 surface not densely pilosulose,
 hairs when present appressed to
 sub-erect 7
- 7 (6). Lower leaf surface with many
 rather long, evenly distributed
 hairs over entire surface *N.*
melastomaefolia var. *Gaudichaudii*
- Lower leaf surface with hairs mostly
 restricted to veins, if in intervals,
 hairs very short 8
- 8 (7). Leaves thick, often triplinerved;
 veins very strongly salient below.
 Flowers of both sexes with pedi-
 cels; calices thick, particularly at
 tips of lobes of staminate calyx
 *N.*
melastomaefolia var. *melastomaefolia*

KEY III

For Identification of Pistillate Plants with Flowers and Fruit

1. Calyx beak attenuate apically 2
 Calyx beak expanded apically 13
- 2 (1). Calyx of flower angled; calyx of
 mature fruit very thick-fleshy,
 sharply ridged, and angled. Lower
 leaf surface sericeous 3
 Calyx of flower not angled; calyx of
 mature fruit not thick-fleshy,
 sharply ridged, or angled 4

- Leaves not thick, usually palmate; venation not strongly raised below. Flowers sessile; calices thin 9
- 9 (8). Many very short, erect or sub-erect, uncinata hairs on veins other than principal veins and primary branches. Apical portion of achene depressed-conic. Leaves drying paler below but not markedly pallid
 . . . *N. melastomaefolia* var. *uncinata*
- No uncinata hairs present on lower leaf surface. Apical portion of achene hemispherical. Leaves drying markedly pallid below
 . . . *N. melastomaefolia* var. *pallida*
- 10 (5). Flowers of both sexes with slender pedicels, 0.5–2 mm. long. Leaf base very often obtuse or sub-obtuse, sometimes cuneate. Very few hairs on lower leaf surface and these restricted for most part to venation. Staminate calyx with all or almost all hairs erect to sub-erect, uncinata
 . . . *N. melastomaefolia* var. *parvifolia*
- Flowers of both sexes usually sessile, staminate flowers sometimes with short pedicels. Leaf base rotund, usually sub-cordate. Lower leaf surface with many erect, irregularly curving and bending or almost straight hairs covering entire surface. Staminate flowers pilosulose, hairs many, erect to sub-erect, ascending
 *N. kauaiensis* var. *kauaiensis*
- 11 (4). Lower leaf surface pubescent. Calyx of staminate flowers with most hairs straight 12
- Lower leaf surface glabrous or very sparsely pilosulose, few ascending, appressed hairs on venation. Calyx of staminate flowers with all or most hairs short, erect, uncinata
 . . . *N. melastomaefolia* var. *parvifolia*
- 12 (11). Lower leaf surface pilosulose, hairs evenly distributed, ascending, appressed or sub-erect. Achene 2.5–3.5 mm. long, averaging 3 mm. long; apical portion conic, without definite, complete constric-
 tion from raised basal portion. Calyx surrounding mature achene, about 6 mm. long when dry . . . *N. melastomaefolia* var. *pubescens*
- Lower leaf surface puberulent, hairs erect or sub-erect. Achene 2–3 mm. long, usually 2 mm. long; apical portion depressed-conic, separated from depressed-convex basal portion by deep, obtuse or acute constriction. Calyx surrounding mature achene 4 mm. long or less *N. ovata*
- 13 (1). Lower leaf surface glabrous or with very few hairs on principal veins. Calyx sparsely pilosulose, hairs few, ascending, appressed. Lower leaf surface drying markedly pallid . . . *N. melastomaefolia* var. *pallida*
- Lower leaf surface puberulent or pilosulose with very many erect or sub-erect, irregularly curving and bending hairs. Calyx densely pilosulose, hairs appressed or sub-erect. Lower leaf surface not drying markedly pallid 14
- 14 (13). Outer margin of achene involute, constriction separating apical and basal portion usually obtuse. Puberulent on lower leaf surface *N. ovata*
- Outer margin of basal portion of achene plane, constriction separating apical portion usually deep and acute. Lower leaf surface with dense covering of grayish, irregularly curving and bending hairs *N. sericea*

KEY IV

For Identification of Staminate Plants

1. Lower leaf surface sericeous 2
 Lower leaf surface glabrous or pilosulose 3
- 2 (1). Leaf margin entire; pubescence on lower leaf surface strictly or mostly appressed, centripetally oriented in primary intervals, producing a geometrically uneven silvery sheen
 *N. angulata* var. *angulata*
- Leaf margin dentate, partly dentate, or rarely entire; pubescence on lower leaf surface sub-erect, hairs

- straight except arcuate apically, mostly centripetally oriented but geometrically uneven sheen less marked *N. angulata* var. *dentata*
- 3 (1). Hairs on calyx lobes all or mostly straight 4
 Hairs on calyx lobes all or almost all short, erect, uncinata; occasionally a few longer, straight, appressed hairs on margins
 *N. melastomaefolia* var. *parvifolia*
- 4 (3). Few to many short, erect, uncinata hairs present on calyx mixed with numerous longer, straight hairs 5
 No uncinata hairs on calyx lobes (or staminate flowers unknown) 8
- 5 (4). Lower leaf surface with few hairs only, largely restricted to venation 6
 Lower leaf surface with many hairs over entire surface 7
- 6 (5). Flowers sessile; calyx lobes thin. Leaves thin, usually palmate; veins not very strongly raised below; many short, erect or sub-erect, uncinata hairs on secondary and smaller vein branches
 *N. melastomaefolia* var. *uncinata*
 Flowers usually pedicelled; calyx lobes thick, especially at tips. Leaves thick, often triplinerved; veins very strongly salient below; uncinata hairs, if present, scattered indiscriminately on lower leaf surface *N. melastomaefolia* var. *melastomaefolia*
- 7 (5). Calyx lobes membranous; lower leaf surface puberulent *N. ovata*
 Calyx lobes thin but not membranous; lower leaf surface densely pilosulose, hairs white or grayish, irregularly curving and bending *N. sericea*
- 8 (4). Lower leaf surface with many hairs; not drying very pallid below 9
 Lower leaf surface with few or no hairs; drying very pallid below (staminate flowers unknown)
 *N. melastomaefolia* var. *pallida*
- 9 (8). Leaf margin entire 10
 Leaf margin irregularly undulate
 *N. kauaiensis* var. *Helleri*

- 10 (9). Leaf base usually rotund, sub-cordate; pubescence on lower leaf surface erect, more or less irregularly curving and bending
 *N. kauaiensis* var. *kauaiensis*
 Leaf base cuneate; pubescence on lower leaf surface appressed or sub-erect, entirely straight 11
- 11 (10). Calyx usually over 4 mm. long, averaging 5 mm. long. Leaves palmately nerved
 *N. melastomaefolia* var. *pubescens*
 Calyx 3–4 mm. long, averaging less than 4 mm. Leaves usually triplinerved *N. melastomaefolia* var. *Gaudichaudii*

Neraudia melastomaefolia Gaudichaud, Freyc. Voy. Uranie Bot.: 500, pl. 117, 1830.

Boehmeria melastomaefolia (Gaud.) H. & A., Bot. Beechey Voy. 2: 96, 1832.

Boehmeria melastomaefolia (Gaud.) Endl., Wien Mus. Naturgesch., Ann. 1: 165, 1836.

Boehmeria melastomaefolia (Gaud.) Steudel, Nom. Bot. 2: 192, 1841.

Shrub or small tree up to 6 m. tall, usually shrub less than 4 m. tall, main stem 1–5 cm. in diameter at base. Upper branchlets pilosulose, with few to many erect or appressed hairs, branchlets arcuate, lax, and pendent or erect. Petioles 1–5.5 cm. long, glabrous or pilosulose with few to many erect or appressed hairs. Leaf blades 4–19.5 cm. long, 1.5–7 cm. wide, elliptic, oblance-elliptic, lanceolate, elliptic-ovate, ovate, or oval, thin to thick, chartaceous or coriaceous, palmate or triplinerved; upper surface glabrous or sparsely pilosulose with few appressed, ascending hairs, lower surface glabrous or pilosulose, hairs few to many, appressed or sub-erect, ascending, restricted to venation or evenly distributed over lower leaf surface, and none to many shorter erect or sub-erect, uncinata hairs; principal veins and primary branches slightly to markedly salient below; margin entire, base cuneate or cuneate-decurrent to obtuse or sub-obtuse or slightly sub-cordate, leaf tip gradually or abruptly tapering into an acute

or acuminate or long-acuminate apex. Pistillate flowers sessile or with filiform pedicels 0.5–2 mm. long; calyx pilosulose, with few ascending, appressed hairs, and with or without some shorter, erect, uncinata hairs; beak usually attenuate apically, sometimes expanded, four-toothed at apex; stigma 2–8 mm. long, receptive on all surfaces or stigmatic hairs absent on one side. Achene 1.0–3.5 mm. long, apical portion sharply conic to depressed-conic, separated from basal portion by slight or incomplete constriction or without constriction, basal portion flattened, depressed-convex or convex, 2–3 mm. in diameter, plane or involute at outer margin; seed ellipsoid or ovoid. Staminate flowers sessile or pedicelled, with four navicular, acutely or acuminate tipped lobes, 4–6 mm. long, 1.5–2.0 mm. wide, pubescence of lobes mostly straight, ascending, appressed or mostly erect or sub-erect uncinata hairs; pistil rudiment 0.3–2.0 mm. long, filaments 2.5–5.0 mm. long, 0.5–1.0 mm. wide, connective swollen-fleshy or unswollen; anthers reniform, 1.5–2.0 mm. long, 0.8–1.0 mm. wide.

The subspecific entities which comprise this species are distinct enough to be considered varieties but to accord them higher rank is, I believe, without justification. I feel that species should show constant morphological characters with no or few intermediate forms whereas varieties very often have such intermediate forms. The varieties *melastomaefolia*, *uncinata*, *pubescens*, and *Gaudichaudii* are superficially similar but variety *parvifolia* has a different aspect.

Hillebrand (1888) included all the groups which he knew in the one species, *N. melastomaefolia*, with a variety, *parvifolia*. This variety was, as Hillebrand's citation shows, a transfer of Wawra's forma *parvifolia* of *N. sericea* (as applied by Wawra) to *N. melastomaefolia*. The transfer is herein accepted and the name applied to one of the varietal groups.

Certain inaccuracies in Gaudichaud's plate have become apparent on examination of his material. The leaves are illustrated as palmate with blunt apices, but the leaf tips in his ma-

terial are sharp and most of the leaves are triplinerved to some degree. The flowers on the pistillate branch of his habit sketch are strikingly similar to those of *Pipturus* and I believe that material of this genus was used for this part of the plate. Gaudichaud's artist shows stipules which are interpetiolar with the appearance of thorns rather than intrapetiolar, membranous structures. The bract-like structure at the base of his young pistillate flower is not uniformly present. The margin of the apex of the calyx neck is actually toothed rather than entire, and the fleshy calyx surrounding the achene is depressed-globose instead of convex. The achene is not stalked and is attached to the calyx on the ventral surface except at the outer margin. The seed is represented in his plate as having a constriction and the seed cavity as extending to the apex of the achene but neither is true. The staminate flowers are really oblong-elliptic rather than globose and the tips of the calyx lobes are much thicker than illustrated.

Neraudia melastomaefolia Gaud. variety *melastomaefolia* Cowan, *var. nov.*

Fig. 1

Neraudia melastomaefolia Gaud., Freyc. Voy. Uranie Bot.: 500, pl. 117, 1830.

Description of Gaudichaud's material: Upper branchlets with many ascending, appressed hairs. Petioles 1.0–4.5 cm. long with few to many ascending, appressed hairs. Leaf blades 8.5–12.0 cm. long, 2.5–4.5 cm. wide, narrow elliptic to oval, thick, mostly triplinerved, glabrous above, lower surface with few ascending, appressed hairs on principal veins, margin entire, base cuneate-decurrent, or only cuneate, apex evenly long-acuminate, principal veins very strongly raised on lower leaf surface. Pistillate flowers on slender pedicels 0.5–2.0 mm. long; calyx with many ascending, appressed hairs and some erect, uncinata hairs; beak attenuate apically; stigma non-receptive on one side. Staminate flowers on pedicels 0.5–1.5 mm. long; calyx with both short, erect, uncinata hairs and longer straight, ascending, appressed hairs, lobes thick,

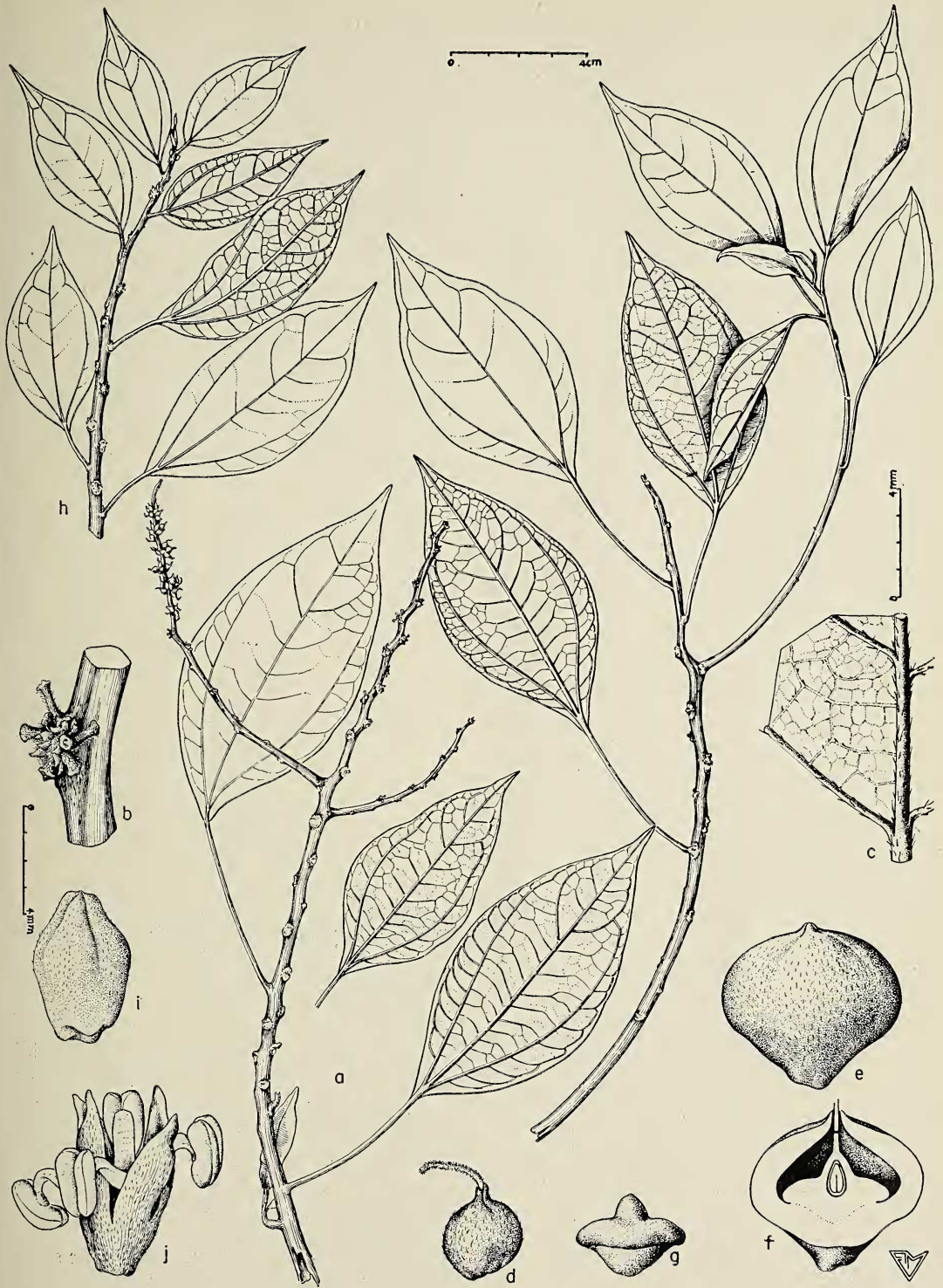


FIG. 1. *Neraudia melastomaefolia* Gaud. var. *melastomaefolia* Cowan. *a-g*, Pistillate plant: *a*, habit (Type); *b*, one node (Type); *c*, portion of lower leaf surface (Type); *d*, young flower (Type); *e*, mature calyx enclosing achene (Frederick 207); *f*, long section through mature calyx and achene (*ibid.*); *g*, external view of achene. *h-j*, Staminate plant: *h*, habit (Gaudichaud); *i*, young flower (St. John 22568); *j*, mature flower (*ibid.*).

especially at tips. No mature achenes present.

Description of all material examined: Spreading shrub 2–6 m. tall, about 3 cm. in diameter at base; upper branchlets pilosulose with many ascending, appressed hairs. Petioles 1.0–4.5 cm. long, averaging about 2 cm. long, pilosulose with many appressed, ascending hairs. Leaf blades 6–13 cm. long, 2.5–7.0 cm. wide, averaging 9 cm. long, 4.5 cm. wide, narrow elliptic, elliptic-ovate, oval, or slightly obovate, thick, sub-coriaceous or coriaceous, very often trip-linerved, above glabrous, below sub-glabrous with only few straight, ascending, appressed hairs mostly restricted to veins, sometimes with very short, scattered hairs in intervals; margin entire, base cuneate and decurrent or sub-obtuse, apex acute or acuminate, tip of apex sharp or blunt, principal veins very strongly raised. Pistillate flowers with pedicels 0.5–2.0 mm. long; calyx sub-glabrous with very few ascending, appressed hairs; beak attenuate apically, apex with four acute or acuminate teeth; stigma 2–3 mm. long, one side usually lacking receptive stigmatic processes. Achene 2.0–2.5 mm. long, averaging 2 mm., apical portion depressed-conic, separated from basal portion by abrupt obtuse constriction or without obvious constriction, basal portion smooth, thick, outer margin plane, 2.5–3.0 mm. in diameter, seed ovoid. Staminate flowers with pedicels 0.5–2.0 mm. long; calyx lobes thick, particularly at tips, pilosulose with many ascending, appressed hairs and with or without some erect uncinata hairs, lobes 3–5 mm. long, 1.5–2.0 mm. wide, apex acute or acuminate; filaments 3.5–5.0 mm. long, 0.5–1.0 mm. wide, tapering at apex into broader, fleshy, swollen connective; anthers 2 mm. long, 1 mm. wide.

Type: Gaudichaud, "In insulis Sandwichensibus, cum sequente (alt. 350–400 hex.)." (In Sandwich Islands, altitude 1,500–2,400 feet.) (Deposited in Museum National d'Histoire Naturelle de Paris [P].)

Range: Island of Oahu, Waianae Range, moist regions, 2,000–3,450 feet altitude.

Specimens examined

Data complete: Haleauau Gulch, Mt. Kaala, *St. John* 22269, 22270 (Ho); Mt. Kaala, *Degener* 18190 (NY); Mt. Kaala, *Cowan and St. John* 333 (Ho); Puu Kalena, *St. John* 22568 (Ho); Puu Kalena, *Donaghho* (Ho); Hapapa Gulch, *Russ* (Ho); Kanehoa, *Frederick* 207, 208, 209, 210 (Ho); Kanehoa, *Cowan* 1054, 1057 (Ho); Makaha Valley, *Forbes* (Ho); Oahu, Waianae, *Faurie* 515 (P, Ho).

Data not complete: Honolulu, Sandwich Islands, *Hillebrand* (K); Oahu, *Seeman* 2260 (G, K, Ho); *Mann & Brigham* 220 (GH, G, Ho); Woahoo, *Macrae* (K); *Gaudichaud* 208 (Bonite Voyage) (G); *Remy* 197, Maui (data very questionable) (P).

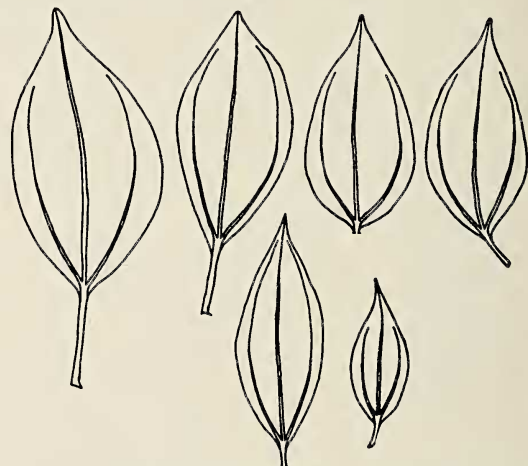


FIG. 2. Outlines of leaves to show variation in leaf shape and in venation in *Neraudia melastomaefolia* Gaud. var. *melastomaefolia* Cowan (approx. $\frac{1}{3}$).

This group seems in several ways to be intermediate between varieties *uncinata* and *parvifolia* and may have arisen as a result of hybridization between the two groups. The pedicels which characterize this group link it to variety *parvifolia* but the leaf shape, size, general aspect, and depressed-conic apex of the achene link it to variety *uncinata*. The occasional presence of some uncinata hairs scattered indiscriminately on the lower surface of the leaves further shows some relationship to variety *uncinata*. Plants of this group may be identified by the pedicelled flowers and by the thick coriaceous character of

the calyx of both types of flowers and of the leaves. The leaves are very often triplinerved, and the upper surface sometimes has a rough scabrous texture, at least when dried. The venation, particularly the principal veins and primary vein branches, is very markedly raised; uncinata hairs on the venation are scattered or absent.

The range of this variety and of variety *parvifolia* nearly coincide except that variety *melastomaefolia* does not extend south of Kaneohe and variety *parvifolia* extends to Palikea and beyond. If this variety did arise by hybridization between variety *parvifolia* and variety *uncinata*, the mixing may have taken place in the Kaala region where, according to theory, a forest once existed between the two mountain ranges. The present distribution, then, would represent the distance to which the group has been distributed since its appearance. There are no real bases for such assumptions; further study, particularly of a cytological nature, may or may not uphold this hypothesis.



FIG. 3. Distribution of *Neraudia melastomaefolia* Gaud. var. *melastomaefolia* Cowan.

Neraudia melastomaefolia Gaud. variety *uncinata* Cowan, var. *nov.*

Fig. 4

Diagnosis typi: A var. *melastomaefolia* differt in foliis subtus pilis multis uncinatis in nervis secundariis, et in floribus sessilibus.

Description of all material examined: Shrub or small tree to 3 m. tall; upper branchlets

usually pendent, sparsely pilosulose. Petioles 1.0–5.5 cm. long, pilosulose, few to many appressed, ascending hairs present. Leaf blades 5–15 cm. long, 2–7 cm. wide, averaging 12 cm. long, 4.5 cm. wide, narrow-elliptic to elliptic, thin, usually palmate; upper surface sparsely pilosulose, hairs few, appressed, ascending on midrib, otherwise glabrous, lower surface hairs on principal veins and primary vein branches ascending, appressed, on other vein branches hairs shorter, erect or sub-erect, uncinata, largely restricted to venation; principal veins and primary branches raised; base cuneate or cuneate and decurrent, apex long-acuminate. Pistillate flowers sessile, calyx sparsely pilosulose, only few, appressed hairs present, beak attenuate apically with four acuminate teeth at apex; stigma 4–5 mm. long, one side not receptive. Achene 1.5–2.0 mm. long, averaging about 2 mm. long, apical portion depressed-conic, separated from basal portion by only slight constriction, basal portion convex, 2–3 mm. in diameter, outer margin plane, not involute; seed ovoid, without constriction. Staminate flowers sessile, acuminate tipped lobes 3.5–4.5 mm. long, 1.5–2.0 mm. wide, averaging 4 mm. long, 2 mm. wide, pilosulose with most hairs appressed, ascending but also with few shorter, sub-erect, uncinata hairs present; pistil rudiment 0.3–2.0 mm. long; filaments 2.5–5.5 mm. long, 0.5–1.0 mm. wide; anthers 1.5–2.0 mm. long, 0.8–1.0 mm. wide.

Type: Cowan 698, Oahu, Waikane–Schofield Trail, Kahana, Koolau Range, September 20, 1947. (Deposited in Bishop Museum [Ho].)

Range: Island of Oahu, Koolau Range, moist to wet forest, 1,800–2,200 feet altitude.

Specimens examined

Data complete: Kailauloa Mts., between Punaluu and Kaipapau, Nov. 14–21, 1908, *Forbes* (Ho); Punaluu, *Rock* 796, 368, 568, 626 (Ho); Punaluu Mt., trail to Castle Camp, *Rock* 8838 (Gr, Ho); Waikane–Schofield Trail, *St. John* 20251, 12120 (Ho), *Fosberg* 8774 (Ho), *Degen* 18185, 18185 (different sexes) (Ho), *Suehiro*, Oct. 16, 1932 (Ho), *Cowan* 56, 57,

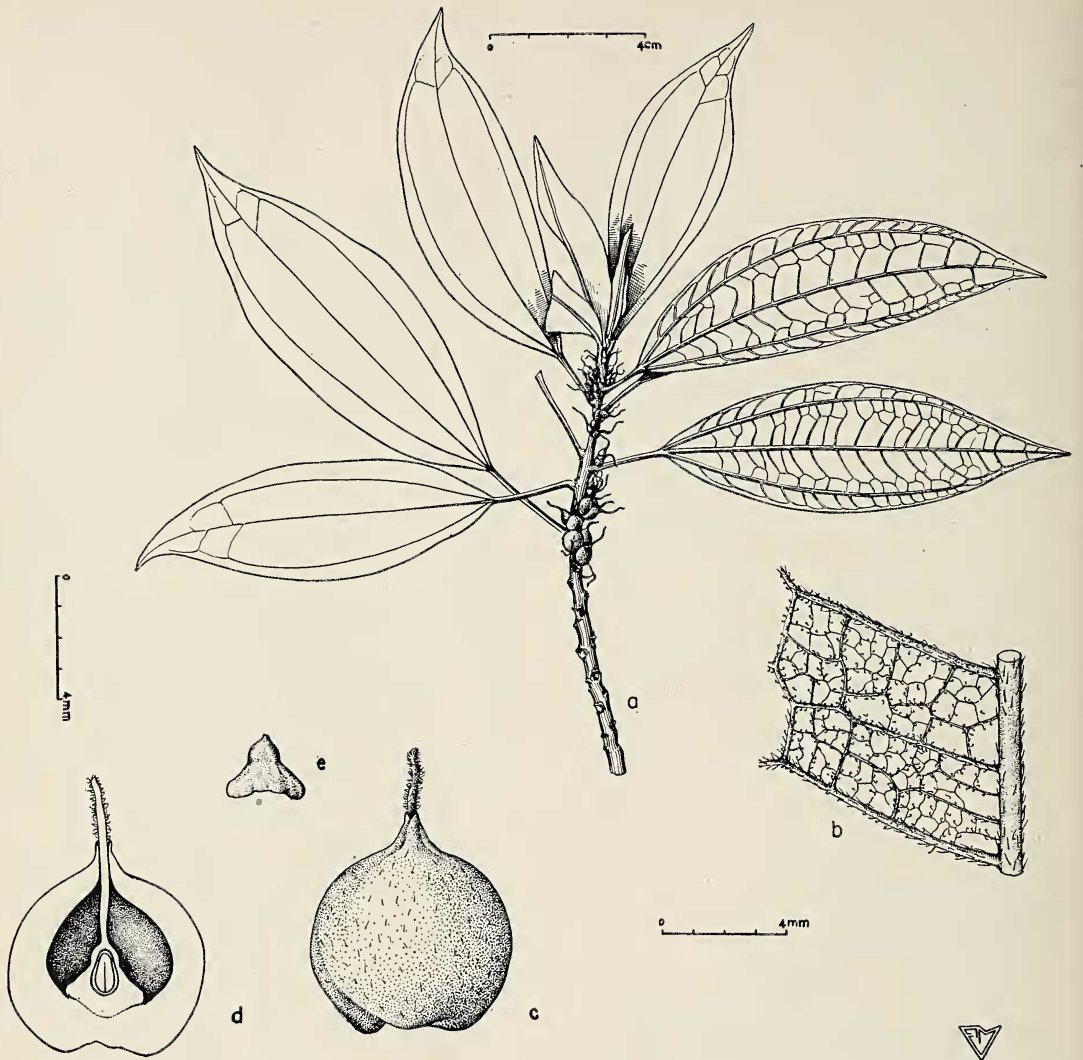


FIG. 4. *Nerandia melastomaefolia* Gaud. var. *uncinata* Cowan. *a-e*, Pistillate plant: *a*, habit (Type); *b*, portion of lower leaf surface (Type); *c*, mature calyx enclosing achene (Type); *d*, long section through mature calyx and achene (Type); *e*, external view of achene.

646, 697 (Ho), Cowan and St. John 7, 8 (Ho), Baxter 120 (Ho); Waiohole Valley, Rock, Dec. 1919 (Ho); east side of Kaala, Bergman (Ho).

The last collection cited above is the only one from the Waianae Range which may be placed in this variety but it is not certain that the locality data are correct. It is intermediate in some ways but it is closest to variety *uncinata* and so is placed here rather than in variety *melastomaefolia*, to which it shows some similarity.

Judging by Wawra's geographical note on his collection of *N. melastomaefolia*, he may have collected a plant of this variety. His locality is "Waiolani" which is in the Koolau Range, the home of variety *uncinata*, and would represent the most southerly occurrence of the group.

This variety may be recognized by the many short, sub-erect or erect uncinata hairs on the secondary and smaller vein branches on the lower leaf surfaces. (The name for this variety

is taken from this diagnostic character of the leaves.) The flowers are sessile, the leaves usually palmately veined, and both leaves and calyx lobes are thin compared to variety *melastomaefolia*.



FIG. 5. Distribution of *Neraudia melastomaefolia* Gaud. var. *uncinata* Cowan (half-black dots) and var. *parvifolia* Cowan (complete black dots).

Neraudia melastomaefolia Gaud. variety *pubescens* Cowan, var. *nov.*

Fig. 6

Diagnosis typi: A var. *melastomaefolia* differt in foliis subtus adpressi vel suberecti-pilosis, achaenibus sine constrictione completa 3 mm. longis marginibus exterioribus involutis.

Description of all material examined: Tree to 6 m. tall with ascending branches, main stem to 13 cm. in diameter; upper branchlets pilosulose, hairs few to many, erect or sub-erect. Petioles 1.0–4.5 cm. long, averaging 2.5 cm. long, pilosulose, hairs few to many, appressed, sub-erect, or erect. Leaf blades 6.0–19.5 cm. long, 1.5–6.5 cm. wide, averaging 10 cm. long, 4 cm. wide, elliptic, thickish, palmate; above glabrous, below pilosulose, many appressed or sub-erect, ascending hairs present; margin entire, base cuneate and decurrent or slightly rounded and sub-obtuse, apex evenly or abruptly long-acuminate. Pistillate flowers sessile, calyx pilosulose, few to many ascending, appressed hairs present, beak attenuate apically with four acute teeth at apex; stigma 3–8 mm. long, one side often without receptive stigmatic hairs; calyx

surrounding mature achene thin, fleshy-coriaceous, 7.5–13.5 mm. long and 6–10 mm. wide, averaging about 10 mm. long and 8 mm. wide when fresh but drying to 5–8 mm. long, and 3.0–5.5 mm. wide, averaging 6 mm. long and 4 mm. wide. Achene 2.5–3.5 mm. long, averaging 3 mm., apical portion conic without complete, definite, constriction at base, basal portion occupying at least half of height of achene, 3–4 mm. in diameter at base, rounded, often deeply furrowed, outer margin strongly involute; seed ovoid with acute apex. Staminate flowers sessile or rarely pedicelled, calyx pilosulose, hairs many, ascending, appressed, and occasionally with few shorter uncinuate hairs, lobes navicular, 3.5–6 mm. long, 1.5–2 mm. wide, with acuminate or long-acuminate apex; pistil rudiment 0.8 mm. long; filaments 3.5–5 mm. long, 0.6–0.8 mm. wide; anthers 1.5–2 mm. long, 0.5–1 mm. wide.

Type: Heller 2792, Kauai, Kaholuamanu, above Waimea, Sept. 2–9, 1895. (Type deposited in Bishop Museum [Ho]; parts of type collection in P, G, UC, GH, NY, and Mich.)

Range: Island of Kauai, rain forest, 3,000–4,000 feet altitude.

Specimens examined

Data complete: Head of Awaawapuhi Valley, Honopu, *St. John et al.* 22890, 22891 (Ho); Waimea, forests of Kokee, *Skottsberg* 993 (Ho); Kokee-Nualolo Trail, *Selling* 3097 (Ho); Near Kokee Stream, *Degener* 18189 (NY); Halemanu, *Rock* 2374 (Ho) (2374–2386 [GH, Ho]); Kaholuamanu, *Rock* 9007 (Ho); Kaholuamanu, *Rock* 5327 (5326–5329) (Ho); Kaholuamanu, *Forbes* 398-K (Ho); Haupu, 2,000 feet, *MacDaniels* 887 (Ho); Waimea Drainage Basin, Kokee, West Side, *Forbes* 829-K (Ho); Waimea Drainage Basin, West Side, Kokee, side of Waimea Canyon, *Forbes* 865-K (Ho); Hii Mountains (Slopes of Puu Kahili, southwest of peak), *Forbes* 667-K (Ho).

Data not complete: Kauai, part of *Mann and Brigham* 624 (Ho).

The character separating this group from variety *uncinata*, which it closely approaches



FIG. 6. *Neraudia melastomaefolia* Gaud. var. *pubescens* Cowan. *a-f*, Pistillate plant: *a*, habit (Type); *b*, portion of lower leaf surface (Forbes 829-K); *c*, young flower (Type); *d*, mature calyx enclosing achene (St. John et al. 22890); *e*, long section through mature calyx and achene (*ibid.*); *f*, external view of achene (*ibid.*). *g-i*, Staminate plant: *g*, habit (Rock 2379); *h*, young flower (*ibid.*); *i*, mature flower (*ibid.*).

in general appearance, is the lack of the many uncinata hairs on the venation of the lower leaf surface. It also differs from *uncinata* in that the hairs are evenly distributed over the entire lower leaf surface and are not restricted to the venation. (The varietal epithet for this entity is drawn from the pubescent condition of the lower leaf surface.) The basal portion of the achene of variety *pubescens* is also distinctive in that it is much raised, very broad, and involute at the outer margin. Also there is no complete constriction separating the apical and basal portions. The only plants of this group observed or on which there are available data were small trees 5 and 6 meters tall, erect, with stout ascending branches; plants of the other varieties of this species are normally weak, branching, or trailing shrubs of 3 meters or less in height.

The collections of this variety are quite uniform in aspect but there are a few minor exceptions which should be noted. The uncinata hairs so characteristic of variety *uncinata* are seldom seen in variety *pubescens* but in *Rock* (1916) and in his collection *Rock 5328* there are many such hairs scattered indiscriminately over the lower leaf surface. The achene, however, is uniform in size and in the involute condition of the outer margin of the basal portion in all of the collections.

KAUAI



FIG. 7. Distribution of *Neraudia melastomaefolia* Gaud. var. *pubescens* Cowan (half-black dots) and *Neraudia kauaiensis* var. *kauaiensis* (complete black dots).

Neraudia melastomaefolia Gaud. variety *parvifolia* (Wawra) Hbd., Fl. Haw. Is.: 416, 1888.

Fig. 8

Neraudia sericea ? fm. *parvifolia* Wawra, Flora 57: 546, 1874.

Neraudia melastomifolia forma *truncata* Skottsberg, Horti Gotob., Acta 15(4): 351, 1944.

Low spreading shrub or half-vine 1–6 m. long; upper branchlets sparsely pilosulose, hairs few, ascending, appressed. Petioles 1–3 cm. long, pilosulose, hairs few, ascending, appressed. Leaf blades 3.0–8.5 cm. long, 1.5–5.0 cm. wide, averaging 6 cm. long, 3 cm. wide, lanceolate, elliptic-lanceolate, elliptic, elliptic-ovate, ovate, or oval, thin to sub-membranous, chartaceous, palmate; above sub-glabrous, with very few, straight, ascending, appressed hairs, below with few, straight, appressed hairs mostly restricted to veins; margin entire, base usually sub-obtuse or obtuse, sometimes slightly cordate or cuneate, apex usually abruptly acuminate or acute, only the principal veins slightly raised. Pistillate flowers on filiform pedicels 0.5–2.0 mm. long, calyx pilosulose with both straight, ascending, appressed hairs and shorter, erect, uncinata hairs, beak attenuate apically with four short, acute teeth at apex; stigma 3–5 mm. long, all sides receptive and stigmatic. Achene 1–2 mm. long, apical portion conic without constriction from basal portion (or rarely depressed-conic with constriction), basal portion flat, thin, outer margin plane, rarely revolute or involute, occasionally lobed, 2–3 mm. in diameter; seed ovoid. Staminate flowers with pedicels 0.5–2.0 mm. long, calyx with many, short, erect or sub-erect, uncinata hairs, longer, straight, appressed, ascending hairs sometimes present on margins of lobes of calyx or at extreme base, lobes 4–5 mm. long, 1.5–2.0 mm. wide, apex abruptly long-acuminate; filaments 3.0–4.5 mm. long, 0.5–1.0 mm. wide; anthers 2 mm. long, 1 mm. wide.

Lectotype: *St. John 10599*, Waianae Range, Puu Hapapa, Honouliuli, on ridge, 2,500 feet

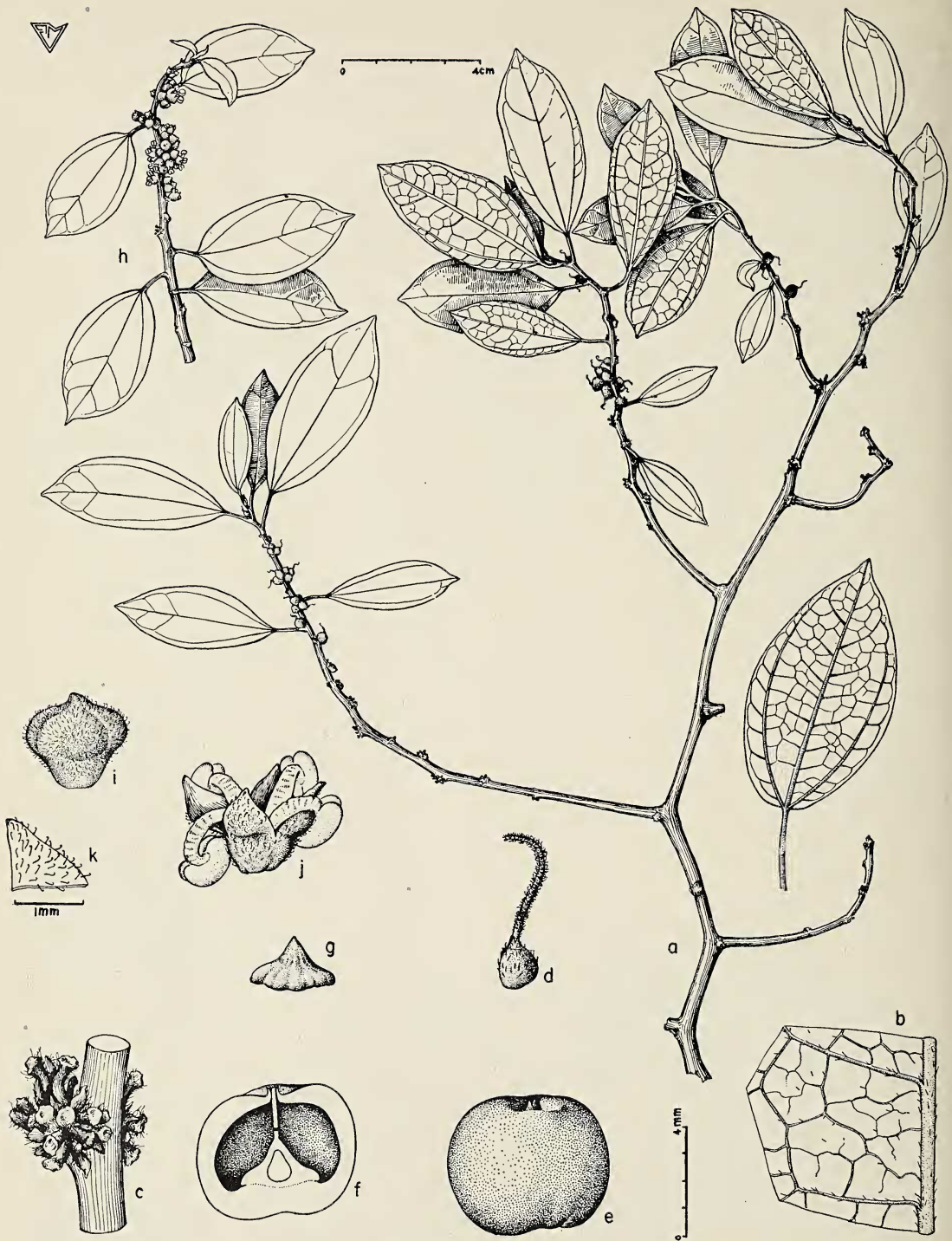


FIG. 8. *Neraudia melastomaefolia* Gaud. var. *parvifolia* (Wawra) Hbd. *a-g*, Pistillate plant: *a*, habit (Lectotype); *b*, portion of lower leaf surface (*ibid.*); *c*, one node (*ibid.*); *d*, young flower (*ibid.*); *e*, mature calyx enclosing achene (Cowan and Sakimura 615); *f*, long section through mature calyx and achene (*ibid.*); *g*, external view of achene (*ibid.*). *h-k*, Staminate plant: *h*, habit (Cowan 673); *i*, young flower (Cowan and Sakimura 616); *j*, mature flower (*ibid.*); *k*, portion of one lobe of calyx (*ibid.*).

altitude, Oct. 19, 1930. (Type deposited in Bishop Museum [Ho].)

Range: Island of Oahu, Waianae Range, moist forest and moist pockets of forest along the ridges, 1,600–3,500 feet elevation, Mt. Kaala to Palikea.

Specimens examined

Data complete: Makaleha Ridge, *Rock 17084* (Ho); Northeast slope of Puu Kumakalii, *Degener 17506* (NY); First large side-valley south of Makua Valley, *Degener 18183* (NY); Makaha Valley, *Forbes* (Ho); Puu Kaala, *Cowan and St. John 325, 316* (Ho); Slope of Kaala, *Selling 3669* (Ho); East ridge of Puu Kaala, *St. John 9933* (Ho); Mt. Kaala, *Nitta 37* (NY); Base of Kaala, northeast side, *Degener 18191* (NY); Mt. Kaala Trail, *MacDaniels 926* (Ho); Puu Hapapa, *St. John 10422* (Ho); Small valley southeast of Puu Hapapa, *Degener 18192* (NY); Small valley northeast of Puu Hapapa, *Degener 18189* (Ho); Southeast slope of Puu Hapapa, *Degener 12235* (Ho); South part of Puu Hapapa, *Selling 3363* (Ho); Puu Hapapa, *Meebold* (Ho); Between Puu Kanehoa and Puu Kaua, *Degener 17192, 17647* (NY); Middle ridge east of Puu Kanehoa, *Degener 12803* (NY); Kanehoa, *Frederick 206* (Ho); In gulch below Kanehoa, *Cowan 1055, 1056* (Ho); Kupehau Gulch, *Cowan and St. John 141, 147* (Ho); Along ridge trail in vicinity of Palikea, *Cowan and Sakimura 615, 616, 617* (Ho), *Cowan 663, 673, 690, 691, 803, 809* (Ho); Kaaikukae, *Russ* (Ho).

Data not complete: *Hillebrand*, no locality (K); Honolulu, *Hillebrand* (K); Oahu, *Forbes* (Ho); Oahu, *Remy 198* (P).

Wawra in 1874 described a forma *parvifolia* of *N. sericea* which Hillebrand raised to varietal status and transferred to *N. melastomaefolia*. The range given by Hillebrand fits very well and the description is adequate for recognition. However, the size of the leaves and petioles described by Wawra and copied by Hillebrand suggests that Wawra probably had an unusually small-leaved form. G. von Beck, in a consideration of Wawra's work, transferred Wawra's

collection (151), originally cited under his forma *parvifolia* of *N. sericea*, to *N. melastomaefolia* but did not consider it to be any different from the "typische Form." In entirety, he says, "Alpine Form mit kleinen Blättern (4 cm. lang), sonst wie die typische Form." In 1935 St. John made a search in the herbarium at Vienna for this material but neither he nor the director was able to locate it. In spite of this, Hillebrand's interpretation of this group is accepted and the name applied.

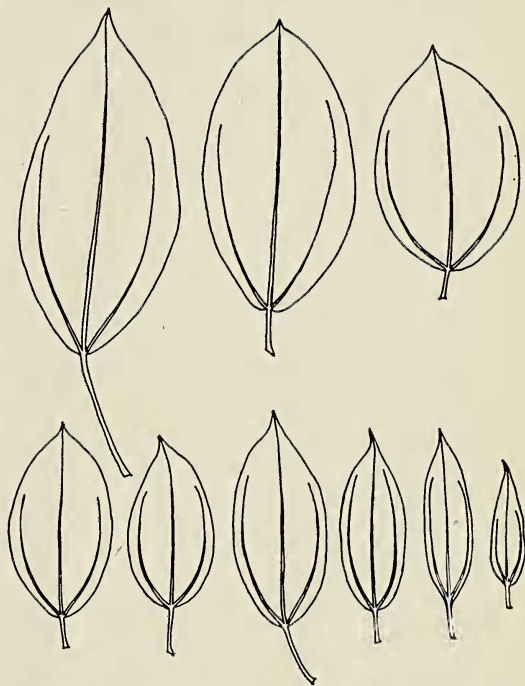


FIG. 9. Outlines of leaves to show variation in leaf shape and size in *Neraudia melastomaefolia* Gaud. var. *parvifolia* (Wawra) Hbd.

Upon first examination of the facts it seemed that Meyen's name, *N. glabra*, should be applied to this group but additional and more detailed study has revealed that Meyen's name is not applicable in this genus. In his journal, writing of his excursion into Nuuanu Valley, he says (translated), "Here we found the plant called 'mamaku' from which the Indians make their ordinary tapa; it belongs to the Urticaceae and is *Neraudia melastomaefolia* Gaud.; a new species of this genus, *Neraudia glabra* n. sp.,

grows here very plentifully and is likewise used in making the cloth." Then in a footnote he described his new species as follows: "N. foliis late ovatis acuminatis crenatis utriusque glabris!" Later, in 1843, in Walpers Enumeration of the family he transferred his own species to *Boehmeria* with a slightly different description: "Foliis (oppositis an alternis?) late ovatis acuminatis crenatis utrinque glaberrimis penninerviis." It seems from the data above that Meyen had a specimen of another genus rather similar in aspect to *Neraudia*, perhaps *Pipturus*. The Hawaiian name "mamake" is recorded by most workers for *Pipturus* and is basically the "mamaku" of Meyen. The crenate margin of the leaves is a definite characteristic of the species of *Pipturus* and the penninerved condition of the leaves which Meyen describes does not fit *Neraudia* at all. Also this group, variety *parvifolia*, occurs only in the Waianae Range. It seems obvious that Meyen's name is based upon something other than *Neraudia* and it is excluded although his material is now impossible to obtain for verification. The director of the herbarium at Vienna has notified us that the section of the herbarium containing the Urticaceae was destroyed by fire during the recent war. This same catastrophe also destroyed Wawra's material.

This group has been the most commonly collected of the genus but it is quite local in its occurrence. It is separated from variety *melastomaefolia* and variety *uncinata* by the almost completely glabrous condition of the lower leaf surface, by the usually sharply conic achene, by the predominance of short, erect, uncinata hairs on the staminate flower calices, by the typically obtuse or sub-obtuse leaf bases, and by the thin to sub-membranous leaves. It has, in common with variety *melastomaefolia*, pedicelled flowers, but it may be separated (even in the sterile condition) by the thinner leaves, the often obtuse or sub-obtuse base, and by the only slightly raised venation. The greatest difficulty in this group is that of getting actively flowering material and the result is that unless the material

is in good flowering or fruiting condition it is difficult to identify with the keys. This is true because the pedicels which characterize the group are present only in a fertile or recently fertile state; Key II should assist in the identification of such collections as are in the vegetative state, without flowers, or only weakly flowering. (See Fig. 5 for distribution.)

Neraudia melastomaefolia Gaud. variety *Gaudichaudii* Cowan, *var. nov.*

Diagnosis typi: A var. *melastomaefolia* differt in foliis subtus adpressi-pilosulis, lobis calycum masculorum sine pilis uncinatis.

Description of all material examined: Shrub; upper branchlets curving, pendent, sparsely appressed pilosulose. Petioles 1-4 cm. long, sparsely pilosulose. Leaf blades 6.5-14.0 cm. long, 3.5-6.0 cm. wide, averaging 9 cm. long, 4 cm. wide, elliptic, thin to thickish, usually triplinerved; above glabrous or with very few appressed hairs, below pilosulose with many long, straight, appressed or sub-erect hairs (0.8-1.0 mm. long) scattered over entire surface; principal veins raised, primary branches less salient; base cuneate and usually markedly decurrent, apex abruptly acuminate with usually a blunt tip. Pistillate flowers sessile, calyx pilosulose with many appressed, ascending hairs, beak attenuate apically with four acuminate teeth at apex; stigma 2-5 mm. long, one side lacking receptive stigmatic hairs. Achene 1.75-2.0 mm. long, apical portion depressed conic, separated from basal portion by only slight constriction, basal portion thickened, flattened, 2.0-2.5 mm. in diameter, outer margin plane. Staminate flowers on short pedicels 0.5-1.0 mm. long, calyx pilosulose with many straight, appressed, ascending hairs, lobes navicular, 3-4 mm. long, 1.0-1.5 mm. wide; filaments 3.5-4.0 mm. long, 0.4-0.5 mm. wide; anther sacs 1.5-2.0 mm. long, 0.75-1.0 mm. wide.

Type: *Selling* 3697, Oahu: Koolau Mts., Punahoa. September 27, 1938. (Type deposited in Bishop Museum [Ho].)

Range: Oahu, Punaluu region of Koolau Range in upper rain forest.

Specimens examined: Pig-God Trail, Punaluu, *Degener 18184* (NY), *17117* (NY); Punaluu, *Webster 1603* (U. of Tex.).

This variety is similar in appearance to variety *uncinata* but differs in its complete lack of uncinata hairs on any plant part, by its staminate flowers borne on pedicels, and by the presence of many rather long hairs scattered over the entire lower leaf surface. In this latter character it resembles variety *pubescens* but differs in its smaller calices, by the depressed-conic apical portion of the achene, and by its usually triplinerved leaves. It is remarkably similar to variety *melastomaefolia* but the long hairs all over the lower leaf surface and the lack of uncinata hairs on any plant part separate it from this variety. Variety *Gaudichaudii* appears to be most closely related to variety *melastomaefolia*.

This variety is named in honor of Charles Gaudichaud, one of the most illustrious botanical travelers of the early exploratory period of the Hawaiian Islands. He described many genera from these islands and the genus *Neraudia* was one of them. He is also the author of three of the species assigned to the genus.

***Neraudia melastomaefolia* Gaud. variety pallida Cowan, var. nov.**

Diagnosis typi: A var. *melastomaefolia* differt in foliis subtus glabris, pallidissimis, floribus sessilibus, rostro calycis ad apicem plerumque expanso.

Description of all material examined: Upper branchlets sub-glabrous with few, straight, ascending, appressed hairs. Petioles 1–3 cm. long, glabrous or sparsely pilosulose with few, ascending, appressed hairs. Leaf blades 6.0–7.5 cm. long, 1.5–3.0 cm. wide, elliptic, oblance-elliptic, or somewhat obovate, thin, palmate; upper surface with very few, ascending, appressed hairs, under surface glabrous or with few hairs on venation; margin entire, base narrowing, cuneate or sub-obtuse, apex abruptly or evenly acuminate or long-acuminate. Pistillate flowers

sessile, calyx with few ascending, appressed hairs, beak expanding apically or sometimes attenuate, four-toothed; stigma 4–7 mm. long and receptive on all surfaces or stigmatic hairs sometimes absent from one side. Achene (mature ?) about 1 mm. long, apical portion hemispherical or elongate-hemispherical without constriction from basal portion, outer margin of basal portion plane, about 2 mm. in diameter; seed ellipsoid. No staminate flowers available.

Type: *Forbes 2365-M*, ridge upper part of Olowalu Valley, Maui, May 14, 1920. (Type deposited in Bishop Museum [Ho].)

Range: Island of Maui, western part.

Specimen examined: *Forbes 2470-M*, up Olowalu Valley and up right-hand side on ridge, May 23, 1920 (Ho).

The material representing this group is so scanty that its evaluation and proper position in relation to other groups are not entirely clear. The group is recognizable and therefore is named in order to call it to the attention of future collectors. It may be separated by the very pallid appearance of the lower leaf surface when dry and the usually expanded beak of the pistillate calyx. (See Fig. 20 for distribution.)

***Neraudia angulata* Cowan, sp. nov.**

Diagnosis: Frutex, 1.5–3.0 m. altus; petiolis 0.8–3.0 cm. longis, perbrevisiter pilosis, laminibus 6.5–13.0 cm. longis, 3.5–5.0 cm. latis, ellipticis vel elliptico-ovatis vel ovatis tenuibus supra adpressi-pilosulosis infra valde curvati-vel adpressi-pilosulosis sericeis marginibus integris vel partim dentatis vel dentatis ad basim cuneatis vel sub-obtusis vel obtusis ad apicem gradatim vel abrupte longi-acuminatis aliquando triplinervatis. Floribus femineis sessilibus, calycibus angulatis valde adpressi-pilosulosis et erecti-pilosulosis, rostro calycis ad apicem contracto acute 4-dentato, stigmatibus 2–8 mm. longo uno latere sine pilis receptivis. Achaenis 1.5–2.0 mm. longis, parte apiculo conico ad basim sine constrictione, parte basali crasso 1.5–2.0 mm. diametro marginibus exterioribus in sicco nonnihil involutis et angulatis,

in calyce carnosio 0.75–1.25 mm. crasso subalato angulatoque inclusis; semene ovato. Floribus masculis sessilibus vel rare pedicellatis, calycibus valde pilosulosis, lobis 2.0–3.5 mm. longis 1.0–1.5 mm. latis anguste navicularibus ad apicem longi-acuminatis, filamentis 4 mm. longis, 0.75 mm. latis, anteris reniformibus 1.5 mm. longis 0.75 mm. latis.

Description of all material examined: Erect shrub 1.5–3.0 m. tall, 1–4 cm. in diameter at base of main stem, upper branchlets with many erect and appressed, or only erect, hairs. Petioles 0.8–3.0 cm. long, with many appressed and erect hairs. Leaf blades 6.5–13.0 cm. long, 3.0–5.5 cm. wide, elliptic-ovate, ovate, or oval, thin, palmate or triplinerved; above sparsely sericeous, hairs ascending, below sericeous with more or less dense layer of strictly appressed or sub-erect hairs, oriented centripetally within primary intervals and mostly directed toward margin, pilosulose on raised principal veins, hairs appressed or sub-appressed; margin entire, repand, partly dentate or completely dentate, base cuneate-decurrent to obtuse and rotund, apex evenly or abruptly long-acuminate or only acute. Pistillate flowers sessile, calyx sericeous, hairs appressed to erect intermixed with some shorter, erect, uncinata hairs, calyx beak attenuate apically with four sub-acuminate to long-acuminate teeth at apex; stigma 2–8 mm. long, without receptive stigmatic hairs on one surface. Achene 1.5–2.0 mm. long, angled, apical portion conic, not separated from basal portion by constriction, basal portion flat-convex, 1.5–3.0 mm. in diameter, outer margin drying involute; seed ovoid. Staminate flowers sessile or with pedicels 1 mm. or less long, calyx sericeous, hairs ascending, lobes navicular, 2.0–3.5 mm. long, 1.0–1.75 mm. wide, apex long-acuminate; filaments 3–4 mm. long, 0.3–0.5 mm. wide; anther sacs 1.5–2.0 mm. long, 0.5–1.0 mm. wide.

This species is separated from all others by the sericeous condition of the plants, particularly of the lower leaf surface and by the conspicuously angled and ridged, fleshy calyx surround-

ing the mature achene. The two varieties comprising the species are separated on the basis of the posture of the hair on the lower leaf surface and on the leaf margin. The name for the species is taken from the angled character of the mature pistillate calyx.

This is the group to which Hillebrand applied Gaudichaud's name, *Neraudia sericea*, when he reduced it to a variety of *N. melastomaefolia*. A fragment of Hillebrand's material, which upon examination proves to be what is named here *N. angulata*, is in the herbarium of Bishop Museum.

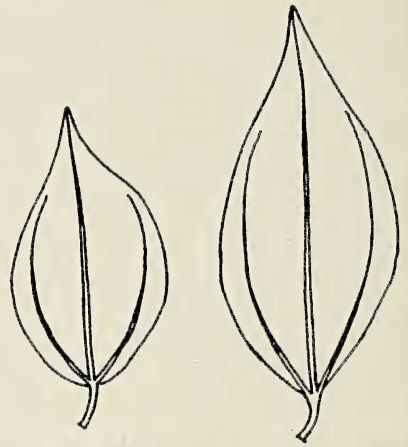


FIG. 10. Leaf outlines to show variation in leaf shape and shape of leaf base in *Neraudia angulata* Cowan var. *angulata* Cowan.

Neraudia angulata Cowan variety *angulata* Cowan, var. nov.

Diagnosis typi: A var. *dentata* differt in foliis marginibus semper integris subtus valde appressi-pilosulosis sericeis.

Description of all material examined: Shrub 2.0–2.5 m. tall. Petioles 1–5 cm. long. Leaf blades 7–13 cm. long, 3.5–5.0 cm. wide, averaging 8 cm. long, 4 cm. wide, elliptic or elliptic-ovate, margin entire, base cuneate-decurrent, apex long-acuminate; below sericeous with more or less dense covering of appressed hairs, centripetally oriented in primary intervals and somewhat marginally directed, producing a conspicuous geometrically uneven sheen on lower leaf surface.

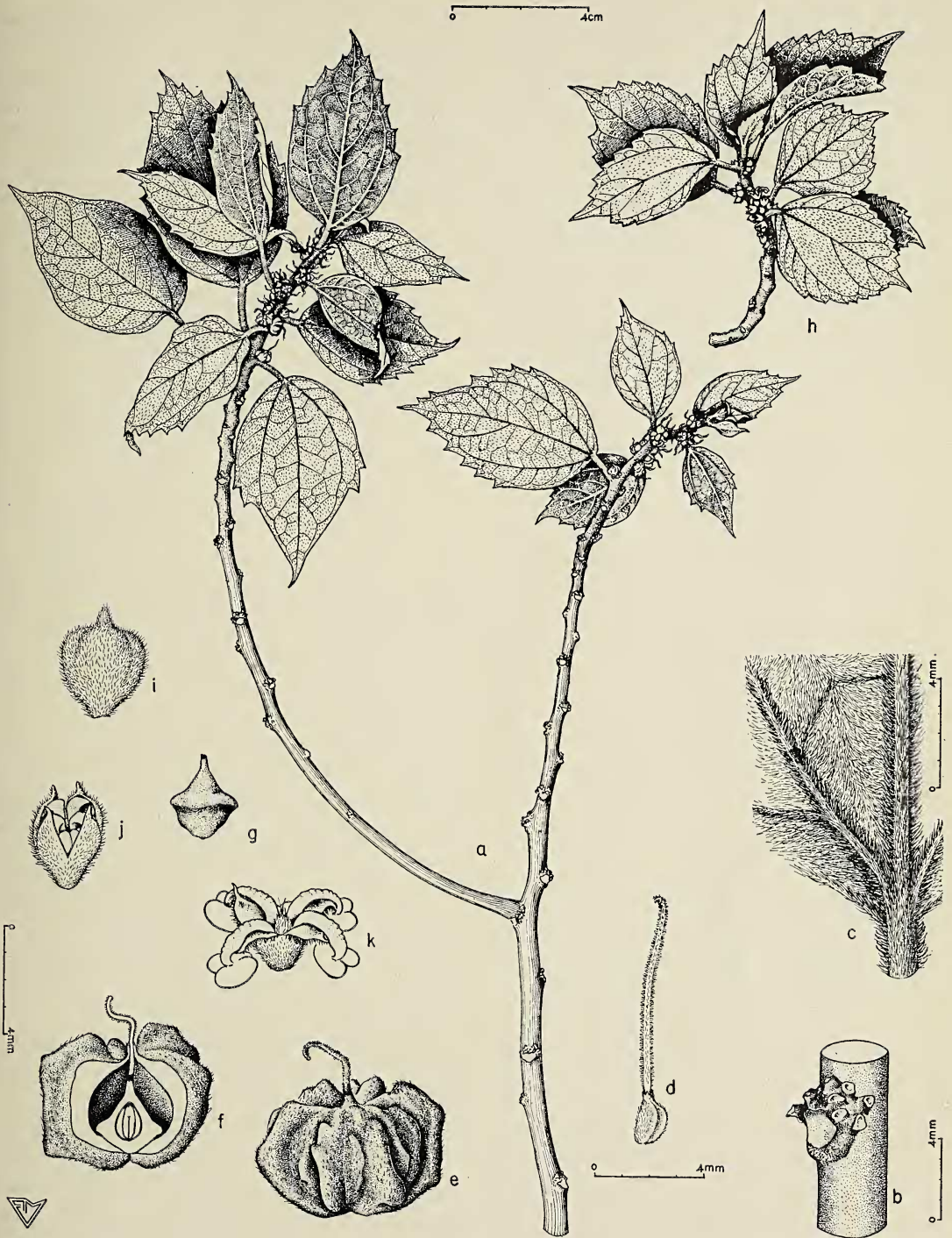


FIG. 11. *Neraudia angulata* Cowan var. *dentata* Degener and Cowan. *a-g*, Pistillate plant: *a*, habit (Type); *b*, one node (Type); *c*, portion of lower leaf surface (Type); *d*, young flower (Type); *e*, mature calyx enclosing achene (Type); *f*, long section through mature calyx and achene (Type); *g*, external view of achene (Type). *b-k*, Staminate plant: *b*, habit (Cowan 761); *i*, young flower (*ibid.*); *j*, opening flower (*ibid.*); *k*, mature flower (*ibid.*).

Type: Forbes 1828-O, Mokuleia, slopes of Kaala, April 26–May 16, 1912. (Type deposited in Bishop Museum [Ho].)

Range: Island of Oahu, Waianae Range, in dry situations 1,900–2,500 feet altitude.

Specimens examined

Data complete: West face of Puu Kalena, Waianae Kai, Fosberg 9264 (Ho); West branch of Waianae Valley at pali near Kolekole Pass, Degener 18182 (NY); Puu Kaua, on easterly ridge, Cowan 840 (Ho).

Data not complete: Honolulu, Hillebrand (K); Hillebrand, no locality (K); Remy 196, Hawaii (almost certainly incorrect locality) (P).

This typical variety may be distinguished from *dentata* by the entire leaf margin and the strictly or mostly appressed hair on the lower leaf surface. Rarely, *dentata* has an entire margin and then it is only the posture of the pubescence which must serve to identify it.

Neraudia angulata Cowan variety *dentata* Degener and Cowan, *var. nov.*

Fig. 11

Diagnosis typi: A var. *angulata* differt in foliis marginibus dentatis subtus valde curvati-pilosulosis sericeis.

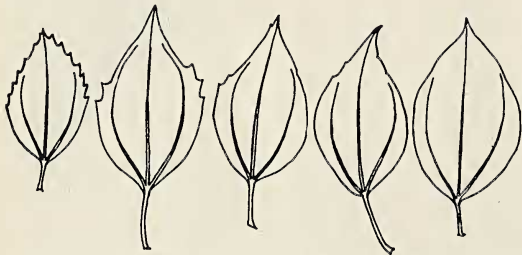


FIG. 12. Leaf outlines to show variation in dentation of leaves in *Neraudia angulata* Cowan var. *dentata* Degener and Cowan.

Description of all material examined: Shrub 1–3 m. tall. Petioles 0.8–3.0 cm. long; leaf blades elliptic, elliptic-ovate, or ovate, margin dentate, partly dentate, repand, or rarely entire, base cuneate-decurrent to obtuse, apex abruptly or evenly long-acuminate or only acute; below densely sericeous, hairs sub-erect or erect, geometrically uneven sheen on lower leaf surface

not so conspicuous as in preceding, owing to more nearly erect hairs, most hairs curving toward margin apically.

Type: Cowan 750, Extension of fire-break trail, west of Puu Iki, Waianae Range, Oahu, December 7, 1947. (Type deposited in Bishop Museum [Ho].)



FIG. 13. Distribution of *Neraudia angulata* Cowan var. *angulata* Cowan (half-black dots) and var. *dentata* Degener and Cowan (complete black dots).

Range: Island of Oahu, Waianae Range, dry areas, 1,200–2,100 feet altitude.

Specimens examined

Data complete: Kaena Uplands, MacCaughy (Ho); Kamananui, second valley east of Puu Iki, Russ (Ho); Extension of fire-break trail, west of Puu Iki, above Mokuleia, Cowan, Webster, and Wilbur 751–763 (Ho), Degener 19181 (NY); Lualualei, central section below Kanehoa, foot of cliffs, head of valley 3, Christophersen 3682, 3685, 3686 (Ho); Lateral easterly ridge, ¼ mile north of Puu Kaua, Cowan 836, 837, 839, 849 (Ho).

The extent of dentation of the leaves of this variety varies considerably but usually leaves with some teeth can be found on each plant. When a collection is discovered with no dentation it is necessary to observe the posture of the pubescence on the lower leaf surface. In this variety the pubescence is sub-erect or erect and the upper part of each hair is usually curved toward the margin.

Otto Degener recently collected some material of this variety and pointed out its dis-

tinctness to me. He then kindly directed me to his locality where fourteen collections were made of plants of both sexes. Although the group had been recognized previously, the material available for its study was quite inadequate so that Mr. Degener's assistance was a very definite contribution and is gratefully acknowledged.

Neraudia kauaiensis (Hbd.) Cowan, *comb. nov.*

Neraudia melastomaefolia Gaud. var. *Kauaiensis* Hbd., Fl. Haw. Is.: 416, 1888.

Upper branchlets grayish at tip with very many straight, erect, or sub-erect hairs. Petioles 1–7 cm. long, with very many straight, erect hairs. Leaf blades 6–12 cm. long, 3.5–7.0 cm. wide, elliptic, elliptic-ovate or broadly ovate, thin, palmate, above with few to many sub-appressed to erect hairs, tuft of hairs at junction of principal veins on upper surface erect, below with very many, more or less erect, irregularly curving and bending or almost straight hairs in intervals; veins densely covered with straight, erect hairs; margin entire or irregularly undulate, base rotund or narrowing, sub-cordate, obtuse, or sub-obtuse, apex abruptly acuminate or long-acuminate. Pistillate flowers sessile, calyx densely pilosulose, hairs many, erect or sub-erect, ascending, beak attenuate apically with four short, acute or acuminate teeth at apex; stigma about 6 mm. long, receptive on all surfaces. Achene about 2 mm. long, apical portion conic, no constriction between apical and basal portions, basal portion flattened, thin, about 2 mm. in diameter, outer margin plane. Staminate flowers sessile, short-pedicelled, or with pedicels up to 2.5 mm. long, calyx with many sub-erect, ascending hairs, lobes navicular, 3–4 mm. long, 1–2 mm. wide, with long-acuminate apex; pistil rudiment less than 1 mm. long, filaments flat, strap-shaped, 2.8–4.5 mm. long, 0.2–0.5 mm. wide; anther sacs reniform, 0.8–2.0 mm. long, 0.4–1.0 mm. wide.

This species is easily separable from all other groups in the genus, except *N. sericea*, on the

basis of the pubescence of the lower leaf surface. The leaves of *N. kauaiensis* usually have a sub-cordate base (except in variety *Helleri* which has irregularly undulate leaf margins) as compared to the usual cuneate base of *N. sericea*. The pubescence on the calices of flowers of both sexes in *N. sericea* is appressed, ascending, whereas the pubescence on the calices in *N. kauaiensis* is erect or sub-erect, ascending. The venation of the leaves of the two groups is different and the achene of *N. sericea* has a deep, usually acute constriction whereas the achene of *N. kauaiensis* has no such constriction.

Neraudia kauaiensis (Hbd.) Cowan variety *kauaiensis* Cowan, *var. nov.*

Fig. 14

Description of all material examined: Petioles 1–6 cm. long, averaging 2 cm. long. Leaf blades 6–11 cm. long, 3.5–7.0 cm. wide, averaging 7 cm. long, 4.5 cm. wide, elliptic-ovate or more often broadly ovate; above sparsely pilosulose, few to many sub-appressed to erect hairs present; margin entire, base rotund, sub-cordate or obtuse. Pistillate flowers sessile. Achenes as in specific description. Staminate flowers sessile or short-pedicelled, calyx lobes 4 mm. long, 1 mm. wide with acuminate apex; filaments 2.8–4.5 mm. long, 0.2–0.5 mm. wide; anther sacs 0.8–2.0 mm. long, 0.4–0.7 mm. wide.

Type: Rock 5323 (Ho) (5322–5331 [Ho, GH]), Kaholuamanu, Kauai. (Type deposited in Bishop Museum [Ho]; portions of this collection series in GH.)

Range: Island of Kauai, wet forests.

Specimens examined

Data complete: On Kaholuamanu, above Waimea, *Heller* 2881 (UC, Ho, G, P, NY, Mich.); Kaholuamanu, *Rock* 17111 (Ho); Waimea Drainage Basin, West Side (Kokee region—from Forbes' field book), *Forbes* 1079-K (Ho); Kalalau Valley, *Forbes* 52-K (Ho).

Data not complete: *Rock* 5922 (Ho); *Mann and Brigham* 624 (in part—due to the group-

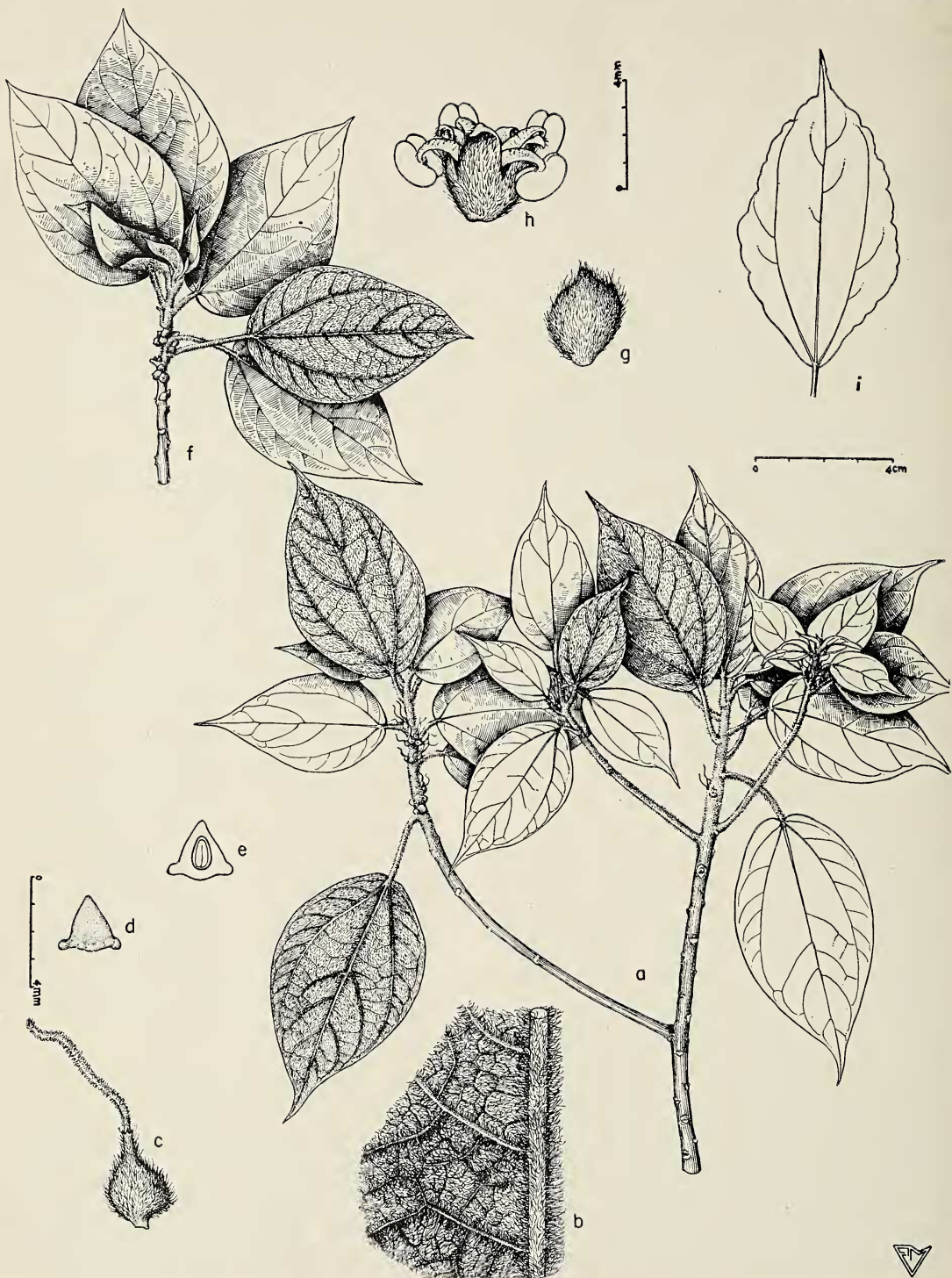


FIG. 14. *Neraudia kauaiensis* (Hbd.) Cowan var. *kauaiensis* Cowan (a-b); var. *Helleri* (i). a-e, Pistillate plant: a, habit (Type); b, portion of lower leaf surface (Type); c, young flower (Type); d, external view of achene (Type); e, long section through achene (Type). f-h, Staminate plant: f, habit (Rock 5331); g, young flower (*ibid.*); h, mature flower (Heller 2881). i, Outline of leaf of var. *Helleri* (Type).



ing of several collections under one number) (GH, G).

This typical variety differs from variety *Helleri* principally in its entire leaf margins. The different leaf shape and the long-pedicelled staminate flowers of variety *Helleri* serve to separate the two varieties.

Neraudia kauaiensis (Hbd.) Cowan variety *Helleri* Cowan, *var. nov.*

Diagnosis typi: A *var. kauaiensis* differt in marginibus foliorum undulatis, petiolis longioribus, pedicellisque longioribus.

Description of all material examined: Petioles 3–7 cm. long, averaging 5 cm. long. Leaf blades 6.5–12.0 cm. long, 3.5–5.5 cm. wide, averaging 8 cm. long, 4 cm. wide, elliptic to elliptic-ovate; above with many very short, appressed or sub-erect hairs; margin irregularly undulate, base obtuse or sub-obtuse. Pistillate flowers unknown. Staminate flowers with pedicels 0.5–2.5 mm. long, averaging 2 mm. long, calyx lobes 3.0–3.5 mm. long, 1.5–2.0 mm. wide; filaments 3–4 mm. long, 0.5 mm. wide; anthers 1.5–2.0 mm. long, 0.8–1.0 mm. wide.

Type: Heller 2847 (NY), "On Kaholuama-noa, above Waimea, October 1–8, 1895," Kauai (NY, P, GH, G). (Type deposited at New York Botanical Garden; also sheets at P, GH, and G.)

Range: Known from the type locality only.

Specimens examined: Only type collection available for study.

Although the material for this group is inadequate, it seems to be a distinct entity to which a name should be applied. It may be distinguished from variety *kauaiensis* by its irregularly undulate leaves and the presence of many long filiform pedicels at each node. No pistillate material is available but it is hoped that future collections in this locality may reveal the nature of the pistillate plants.

The name for this group was chosen in recognition of the outstanding field work accomplished by A. A. Heller in the Hawaiian Islands in 1895. His very acute powers of observation

and awareness of plant differences resulted in the description of many new species and in a collection of much valuable material.

Neraudia ovata Gaud., Freyc. Voy. Uranie Bot.: 501, 1830.

Fig. 15

Neraudia pyriformis Gaud., Freyc. Voy. Uranie Bot.: 94, 1826 (nomen nudum).

Boehmeria ovata (Gaud.) Endl., Wien Mus. Naturgesch., Ann. 1: 165, 1837.

Boehmeria ovata (Gaud.) Steudel, Nom. Bot. 2: 192, 1841.

Neraudia melastomaefolia Gaud. var.- β Wedd., Mus. Hist. Nat. Paris, Nouv. Arch. 9: 438–439, 1856–57.

Description of Gaudichaud's material: Upper branchlets with many short, straight, erect hairs. Petioles 1–2 cm. long. Leaves 5–6 cm. long, 3–4 cm. wide, ovate or oval, thin, palmate; above with few, very short, ascending, appressed hairs, below puberulent with many very fine, more or less erect, very short, straight or slightly bending hairs; margin entire, base obtuse or cuneate, apex contracted abruptly into an acuminate or long-acuminate tip. Pistillate flowers sessile, calyx pilosulose, hairs many, short, ascending, appressed, and with few erect, uncinuate hairs intermixed, beak expanded or attenuate apically. Achene about 2 mm. long, apical portion depressed-conic, separated from basal portion by obtuse constriction, basal portion raised, involute at outer margin, about 2.5 mm. in diameter. No staminate flowers available.

Description of all material examined: Vining, sprawling, rarely erect shrub 1–3 m. tall with a spread of 3–7 m., sometimes clambering over adjacent vegetation, main stem up to 5 cm. in diameter at base; upper branchlets pilosulose, with many short, erect hairs. Leaf blades 3–10 cm. long, 2–6.5 cm. wide, elliptic, elliptic-ovate, ovate, broadly ovate, or oval, thin, palmate; above sparsely puberulent, below more densely puberulent; margin entire, base usually obtuse or sub-obtuse, sometimes cuneate, apex abruptly or evenly acuminate or long-acuminate, occasion-



FIG. 15. *Nerandia ovata* Gaud. *a-g*, Pistillate plant: *a*, habit (Type); *b*, one node (Type); *c*, portion of lower leaf surface (Cowan *et al.* 481); *d*, young flower (*ibid.*); *e*, mature calyx enclosing achene (*ibid.*); *f*, long section through mature calyx and achene (*ibid.*); *g*, external view of achene (*ibid.*). *b-j*, Staminate plant: *b*, habit (Cowan *et al.* 477); *i*, young flower (Cowan *et al.* 486); *j*, mature flower (*ibid.*).

ally only acute. Pistillate flowers sessile, calyx pilosulose, with dense covering of appressed to sub-erect hairs and shorter, erect, uncinuate hairs, beak expanded or attenuate apically, four-toothed or three-toothed and collar-form; stigma 4–7 mm. long, receptive on all surfaces. Achene 2–3 mm. long, apical portion depressed conic, separated from basal portion by complete, obtuse, or acute constriction, basal portion raised and sometimes somewhat lobed, about 3 mm. in diameter, outer margin involute; seed ovoid with lateral, transverse constriction. Staminate flowers sessile or on pedicels 1 mm. or less in length, calyx pilosulose with dense covering of appressed and erect hairs, with shorter, erect, uncinuate hairs intermixed, lobes membranous, with long-acuminate apex, 3.0–4.5 mm. long, 1.0–1.5 mm. wide; pistil rudiment 0.3–1.0 mm. long, filaments 3–5 mm. long, 0.5–0.75 mm. wide, anther sacs 1–2 mm. long, 0.5–1.0 mm. wide.

Type: Gaudichaud, "In insulis Sandwicensibus." (Type deposited in Museum National d'Histoire Naturelle de Paris [P].)

Range: Island of Hawaii, dry parts of lava fields 1,000–3,000 feet altitude.

Specimens examined

Data complete: Peter Lee Road near Half-Way House, *Fagerlund and Mitchell 842* (Ho); Kau, *Rock 8776* (Ho, GH); Kapua, *MacDaniels* (Ho); Kanahaha, Kona, *Forbes 361-H* (Ho); Puuwaawaa, *Forbes 28-H* (Ho); North Kona, below Lind's Place and Puuwaawaa branch road, *Skottsberg 1956* (Ho); Puuwaawaa, *Degener 18187* (NY); North Kona, Puuwaawaa, *Skottsberg 673* (Ho); Puuwaawaa, $\frac{3}{4}$ mile west of Puu Anahulu, *Cowan 483–486* (Ho); Puuwaawaa, North Kona, *Fagerlund and Mitchell 1019* (Ho); Huehue, North Kona, *Rock 4015* (Ho) (4013–4017 [GH, Ho]); North Kona, vicinity of Huehue near main road, *Selling 3203* (Ho); Huehue, North Kona, *Frederick* (Ho); North Kona, near Lind's Place, *Skottsberg 1962* (Ho); Huehue, *Meebold* (Ho); Near Huehue Ranch, Kaupulehu, *Cowan et al. 477–482* (Ho).

The leaf shape in this species is variable and though it is not always ovate as Gaudichaud supposed, there is a tendency in that direction. The material on which Gaudichaud based his description shows leaves which are predominantly broadly ovate but the many later collections show the inconstancy of this character. In several of the collections a few or all the leaves are elliptic but the extreme of this condition is reached in *Cowan et al. 485* in which the leaves are narrow elliptic with a long-acuminate apex and cuneate base and the petioles average longer than in the remainder of the material. A group of some status might be segregated on these differences but I have not been convinced of the justification of such a segregation.

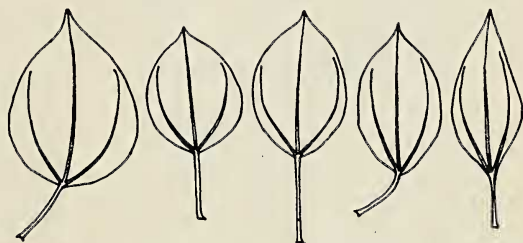


FIG. 16. Leaf outlines to show variation in leaf shape in *Neraudia ovata* Gaud.

The shape and size of the achene are generally constant, at least in the involution of the outer margin of the basal portion. However, in *Forbes 28-H* and *361-H* the outer margin is thin and plane instead of strongly involute as is typical.

This species is unlike any other group in the genus in its vining or clambering habit. From limited observations, it seems that the plants remain more or less erect shrubs with lax, arcuate, branches until of considerable size. That the vine-like habit is characteristic is indicated by several very large (up to 7 m. long) plants which were observed to be clambering over and into adjacent *Metrosideros* trees. Ten collections of the group were made on Hawaii during December, 1946. The plants were found growing in dry soil or out of

crevices between boulders of rough lava. Several seedlings were collected from beneath one pistillate plant and one of these was successfully grown for 18 months in the cool, humid conditions of Manoa Valley on Oahu. This fact would seem to indicate that the plant is capable of considerable adjustment, for the conditions under which it grew on Oahu are nearly the opposite of those in the original locality. The puberulent character of the leaves and their shape remained typical after a year and a half of cultivation. It flowered twice, producing pistillate flowers. Pollination with pollen from an Oahu plant (of another species) was attempted without success. This observation may indicate that genetic barriers exist between some of the groups.

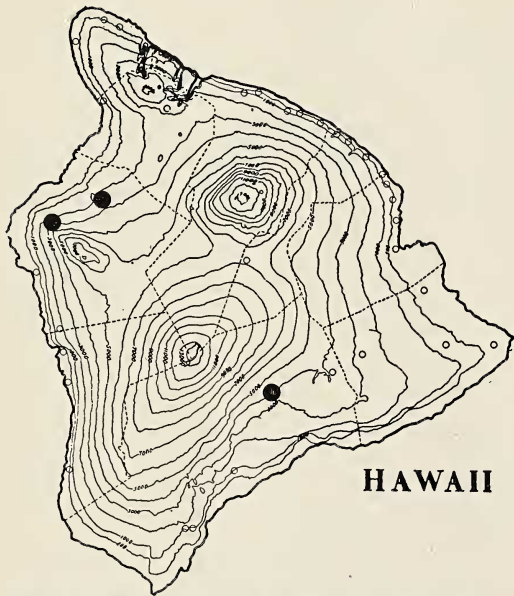


FIG. 17. Distribution of *Nerandia ovata* Gaud.

Nerandia sericea Gaud., Bot. Voy. Bonite: pl. 133, 1851.

Fig. 18

Description of Gaudichaud's material: Upper branchlets pilosulose, hairs many, erect, or sub-erect, ascending. Petioles 1–3 cm. long, pilosulose, hairs many, irregularly bending. Leaf blades 7.0–9.5 cm. long, 4.0–6.5 cm. wide, broadly oval or ovate, rather thickish, tripli-

nerved or palmate; above with few ascending, appressed hairs and tuft of hair at point of divergence of principal veins also appressed, ascending, below densely pilosulose, hairs irregularly bending and curving, grayish or whitish, rather shiny, 0.8 mm. or more long; on upper surface of venation hairs ascending, appressed, on lateral surfaces hairs divergent; margin entire, base cuneate or sub-obtuse, apex contracted abruptly or tapering evenly into an acute to long-acuminate tip, principal veins raised on lower leaf surface. Pistillate flowers sessile, calyx pilosulose with many straight, ascending, appressed hairs; stigma with one side lacking stigmatic hairs. No mature achenes or staminate flowers available.

Description of all material examined: Upper branchlets with very many short, erect or sub-erect hairs. Petioles 0.8–5.0 cm. long, averaging 3 cm. long, with many erect to sub-erect hairs. Leaf blades 3.5–8.5 cm. long, 2–5 cm. wide, averaging 7 cm. long, 4 cm. wide, thin to thickish, narrowly elliptic, elliptic-ovate, ovate, slightly obovate, oval, or broadly oval, mostly triplinerved; above pilosulose with many ascending, appressed hairs, tuft of hairs at junction of principal veins on upper surface appressed, ascending, below densely pilosulose, hairs irregularly bending and curving, grayish or whitish, pilosulose on principal veins and primary branches, hairs appressed, ascending, lateral surfaces of veins with or without fringe of hairs oriented at approximately 90° to the veins; margin entire or rarely a few teeth present on very young leaves, base cuneate, rarely sub-obtuse or obtuse, apex abruptly or sometimes evenly long-acuminate, acuminate, or acute. Pistillate flowers sessile, calyx pilosulose with many straight, appressed, ascending hairs and few shorter, erect, uncinuate hairs, beak expanded apically or rarely attenuated to four-toothed, entire, or laciniate apex; stigma 3–5 mm. long, all sides receptive. Achene 1.5–2.0 mm. long, apical portion depressed-conic, separated from basal portion by deep, acute or obtuse constriction, basal portion flat-convex, 2.5–3.0 mm.



FIG. 18. *Neraudia sericea* Gaud. *a-e*, Pistillate plant: *a*, habit (Rock); *b*, portion of lower leaf surface (Rock); *c*, young flower (Type); *d*, external view of achene (Rock); *e*, long section through achene (Rock). *f-h*, Staminate plant: *f*, habit (Forbes 2324-M); *g*, young flower (*ibid.*); *h*, mature flower (*ibid.*).

in diameter, outer margin plane; seed ovoid with constriction in upper part. Staminate flowers sessile or with pedicels 1–2 mm. long, calyx pilosulose with many, straight, ascending, mostly appressed hairs as well as scattered, shorter, erect, uncinuate hairs, lobes with slightly reflexed tip, 3.0–3.5 mm. long, 0.5–1.5 mm. wide; pistil rudiment 0.5 mm. long; filaments 3.0–4.5 mm. long, 0.5 mm. wide; anther sacs 1–2 mm. long, 0.5–0.8 mm. wide.

Type: Gaudichaud, Iles Sandwich. (Type deposited in Museum National d'Histoire Naturelle de Paris [P].)

Range: Islands of Maui, Molokai, and Lanai, dry gulches and lava flows, 2,200 feet altitude.

Specimens examined

Data complete: Molokai.—Kamola, *Faurie* 514 (Ho); Slopes of Kolekole, *Forbes* 221-Mo (Ho); Near Laianui, *Degener* 4264 (NY, UC). Lanai.—Mts. near Koele, *Forbes* 74-L (Ho); Kaiholena, *Munro* 136 (Ho); Kaiholena, *Munro* 29 (Ho). Maui.—Nuu, *Forbes* 1915-M (Ho); Auwahi, East Maui, *Rock* 8647 (Ho); Olowalu, *Forbes* 2324-M (Ho); Honuaua, *Hillebrand* (K); Slopes of Haleakala, near Kaupo, *Rock* 8648 (Ho, GH); Waihualale Gulch, slopes of Haleakala, *Forbes* 1824-M (Ho).

Data incomplete: Maui.—East Maui, *Hillebrand*; Kawaihi i'uke, Hawaii, *Hillebrand* (K); Hawaii, *Remy* 196 (in part) (P). Data of last two collections are questionable.

This species was published only as a plate in the volume of drawings of plants collected by Gaudichaud on his second voyage, on "La Bonite." He did not describe the group but the publication of the plate legitimizes the name. As a result of his failure to supply a description, faulty interpretation of the group by subsequent authors has been the rule. It was not until his material was studied that the writer was able to apply the name properly. Hillebrand misapplied the name to what is named here *N. angulata* and Wawra also misunderstood the group, applying the name to *N. kauaiensis*. Although Hillebrand's type is not avail-

able, it is likely from the description that his *N. Kaboolawensis* was a Kahoolawe representative of *N. sericea* or, at least, closely related.

The variability in this species is such that a much greater mass of material is necessary before the group can be understood fully. Adequate material may reveal sub-specific entities, for within the material available is some which does have a somewhat different aspect but close examination has failed to reveal any natural bases of segregation. Intensive collecting on Maui, Molokai, and Lanai is necessary before a proper evaluation of the group can be made. The two collections from Lanai have petioles which are half as long as the leaf blades while the leaves of the Maui and Molokai material have petioles one-third or less as long as the leaf blades. In the Maui and Molokai material the main parts of the venation are outlined by very many sub-erect hairs placed almost perpendicularly to the lateral surfaces of these veins. Not all of the Lanai material shows this fringe of hairs. These differences do not seem important enough to justify another group unless subsequent collections show these characters in addition to others of more significance.



FIG. 19. Outlines of leaves to show variation in leaf shape in *Neraudia sericea* Gaud.

Rock 8647 and part of *Rock* 8648 are collections of a staminate plant from Maui and are notable because of the occasional presence of a few teeth on the margin of young leaves. In the *Rock* collection, used here for Figure 18, the achenes have a constriction which is more obtuse than is typical. In *Forbes* 2324-M,

the pubescence has a tendency to be directed toward the margin in contrast to being more or less erect as is typical. *Forbes 1915-M* has leaves which are smaller than the average of the other collections, averaging 4 cm. long by 2.5 cm. wide. In this collection, also, the nodes are conspicuous because of the mass of pedicels at each node.

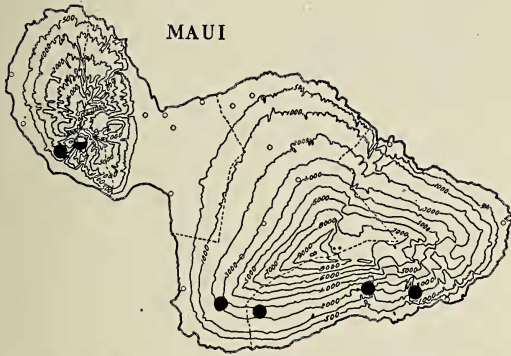


FIG. 20. Distribution of *Neraudia melastomaefolia* Gaud. var. *pallida* Cowan (half-black dots) and *Neraudia sericea* Gaud. on Maui (complete black dots).

Many of the remarks concerning Gaudichaud's plate for *N. melastomaefolia* apply equally well to his plate which stands in lieu of a description of *N. sericea*. The material upon which Gaudichaud based his concept has been carefully examined and the following remarks are based on a comparison of his plate with his material: One of his sheets bears material which is obviously that which was used for the habit sketch, judging from the shape and size of the leaves. The sheet now completely lacks flowers with only scars present to show where flowers were originally situated. The number of scars, however, would indicate far fewer flowers than shown on the plate. The staminate branch shown has the flowers arranged in a most atypical manner and no staminate material collected by Gaudichaud has been received. The beak of the calyx of the pistillate flower is reasonably accurate although that of the fruiting calyx shows this character better. The conspicuous depression at the base of the beak in Gaudichaud's plate is a condition which has not been observed and its existence is

doubtful. The achene shown is not completely mature, as the mature forms usually show a deeper, more acute constriction between the apical and basal portion. The architecturally attractive but biologically inaccurate scroll-work shown at the base of the achene does not exist. Likewise, the swollen, evenly rounded lobes of the basal portion are without basis. The staminate flowers and flower parts are unquestionably copied directly from those on the plate of *N. melastomaefolia*. Every single drawing in the two plates of staminate flower parts is identical (except that the style of shading is different, indicating the work of different illustrators), the calyx lobes and stamens have the same angle between them, their posture is the same, and the pubescence is the same in both. The duplication and the fact that no staminate material of this group collected by Gaudichaud has been received suggest that the artist who made this plate had no material of a staminate plant.

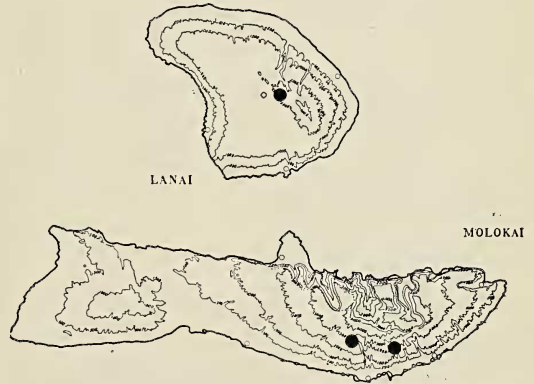


FIG. 21. Distribution of *Neraudia sericea* Gaud. on Molokai and Lanai.

COLLECTORS AND COLLECTIONS OF GENUS

Following is a tabular account of the collections made in the genus *Neraudia* and which are cited in this discussion. Each collection is listed alphabetically and chronologically and the group to which it has been assigned by the writer accompanies each. This table has been prepared to facilitate finding the group to which a particular specimen has been assigned.

COLLECTOR AND NUMBER	GROUP TO WHICH ASSIGNED	COLLECTOR AND NUMBER	GROUP TO WHICH ASSIGNED
BAXTER 120	<i>N. melastomaefolia</i> var. <i>uncinata</i>	FAGERLUND AND MITCHELL 842, 1019	<i>N. ovata</i>
BERGMAN No number	<i>N. melastomaefolia</i> var. <i>uncinata</i>	FAURIE 514	<i>N. sericea</i>
CHRISTOPHERSEN 3682, 3685, 3686	<i>N. angulata</i> var. <i>dentata</i>	515	<i>N. melastomaefolia</i> var. <i>melastomaefolia</i>
COWAN 7, 8, 56, 57, 646, 697, 698	<i>N. melastomaefolia</i> var. <i>uncinata</i>	FORBES Nov. 14-21, 1908	<i>N. melastomaefolia</i> var. <i>uncinata</i>
663, 673, 690, 691, 803, 809	<i>N. melastomaefolia</i> var. <i>parvifolia</i>	398-K, 667-K, 829-K, 865-K	<i>N. melastomaefolia</i> var. <i>pubescens</i>
840	<i>N. angulata</i> var. <i>angulata</i>	No number	<i>N. melastomaefolia</i> var. <i>parvifolia</i>
836, 837, 839, 849	<i>N. angulata</i> var. <i>dentata</i>	2365-M, 2470-M	<i>N. melastomaefolia</i> var. <i>pallida</i>
1054, 1057	<i>N. melastomaefolia</i> var. <i>melastomaefolia</i>	1828-O	<i>N. angulata</i> var. <i>angulata</i>
1055, 1056	<i>N. melastomaefolia</i> var. <i>parvifolia</i>	52-K, 1079-K	<i>N. kauaiensis</i> var. <i>kauaiensis</i>
COWAN, et al. 477, 478, 479, 480, 481, 482, 483, 484, 485, 486	<i>N. ovata</i>	28-H, 361-H	<i>N. ovata</i>
COWAN AND ST. JOHN 141, 147, 316, 325	<i>N. melastomaefolia</i> var. <i>parvifolia</i>	74-L, 221-Mo, 1824-M, 1915-M, 2324-M	<i>N. sericea</i>
333	<i>N. melastomaefolia</i> var. <i>melastomaefolia</i>	FOSBERG 8774	<i>N. melastomaefolia</i> var. <i>uncinata</i>
COWAN AND SAKIMURA 615, 616, 617	<i>N. melastomaefolia</i> var. <i>parvifolia</i>	9264	<i>N. angulata</i> var. <i>angulata</i>
COWAN, WEBSTER, AND WILBUR 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763	<i>N. melastomaefolia</i> var. <i>parvifolia</i>	FREDERICK 207, 208, 209, 210	<i>N. melastomaefolia</i> var. <i>melastomaefolia</i>
DEGENER 18190	<i>N. melastomaefolia</i> var. <i>melastomaefolia</i>	206	<i>N. melastomaefolia</i> var. <i>parvifolia</i>
18185	<i>N. melastomaefolia</i> var. <i>uncinata</i>	No number	<i>N. ovata</i>
18189	<i>N. melastomaefolia</i> var. <i>pubescens</i>	GAUDICHAUD 208	<i>N. melastomaefolia</i> var. <i>melastomaefolia</i>
12803, 12235, 17192, 17506, 17647, 18183, 18189, 18191, 18192	<i>N. melastomaefolia</i> var. <i>parvifolia</i>	No number	<i>N. melastomaefolia</i> var. <i>melastomaefolia</i>
18182	<i>N. angulata</i> var. <i>angulata</i>	No number	<i>N. ovata</i>
19181	<i>N. angulata</i> var. <i>dentata</i>	No number	<i>N. sericea</i>
18187	<i>N. ovata</i>	HELLER 2792	<i>N. melastomaefolia</i> var. <i>pubescens</i>
4264	<i>N. sericea</i>	2847	<i>N. kauaiensis</i> var. <i>Helleri</i>
17117, 18184	<i>N. melastomaefolia</i> var. <i>Gaudichaudii</i>	2881	<i>N. kauaiensis</i> var. <i>kauaiensis</i>
DONAGHHO <i>N. melastomaefolia</i> var. <i>melastomaefolia</i>		HILLEBRAND MACCAUGHEY No number	<i>N. angulata</i> var. <i>dentata</i>
		MACDANIELS 887	<i>N. melastomaefolia</i> var. <i>pubescens</i>
		926	<i>N. melastomaefolia</i> var. <i>parvifolia</i>
		No number	<i>N. ovata</i>

COLLECTOR AND NUMBER	GROUP TO WHICH ASSIGNED	COLLECTOR AND NUMBER	GROUP TO WHICH ASSIGNED
MANN AND BRIGHAM		RUSS	
220	<i>N. melastomaefolia</i> var. <i>melastomaefolia</i>	No number	<i>N. melastomaefolia</i> var. <i>melastomaefolia</i>
624 (part)	<i>N. melastomaefolia</i> var. <i>pubescens</i>	No number	<i>N. melastomaefolia</i> var. <i>parvifolia</i>
624 (part)	<i>N. kauaiensis</i> var. <i>kauaiensis</i>	No number	<i>N. angulata</i> var. <i>dentata</i>
MEEBOLD		ST. JOHN	
No number	<i>N. melastomaefolia</i> var. <i>parvifolia</i>	22269, 22270, 22568	<i>N. melastomaefolia</i> var. <i>melastomaefolia</i>
No number	<i>N. ovata</i>	12120, 20251	<i>N. melastomaefolia</i> var. <i>uncinata</i>
MUNRO		22890, 22891	<i>N. melastomaefolia</i> var. <i>pubescens</i>
29, 136	<i>N. sericea</i>	9933, 10422, 10599	<i>N. melastomaefolia</i> var. <i>parvifolia</i>
NITTA		SEEMAN	
37	<i>N. melastomaefolia</i> var. <i>parvifolia</i>	2260	<i>N. melastomaefolia</i> var. <i>melastomaefolia</i>
REMY		SELLING	
196	<i>N. sericea</i>	3097	<i>N. melastomaefolia</i> var. <i>pubescens</i>
197	<i>N. melastomaefolia</i> var. <i>melastomaefolia</i>	3203	<i>N. ovata</i>
198	<i>N. melastomaefolia</i> var. <i>parvifolia</i>	3363, 3669	<i>N. melastomaefolia</i> var. <i>parvifolia</i>
ROCK		3697	<i>N. melastomaefolia</i> var. <i>Gaudichaudii</i>
368, 568, 626, 796, 8838, Dec. 1919	<i>N. melastomaefolia</i> var. <i>uncinata</i>	SKOTTSBERG	
2374, 5327, 9007	<i>N. melastomaefolia</i> var. <i>pubescens</i>	993	<i>N. melastomaefolia</i> var. <i>pubescens</i>
17084	<i>N. melastomaefolia</i> var. <i>parvifolia</i>	673, 1956, 1962	<i>N. ovata</i>
5323, 5922, 17111	<i>N. kauaiensis</i> var. <i>kauaiensis</i>	SUEHIRO	
4015, 8776	<i>N. ovata</i>	No number	<i>N. melastomaefolia</i> var. <i>uncinata</i>
8647, 8648	<i>N. sericea</i>	WEBSTER	
		1603	<i>N. melastomaefolia</i> var. <i>Gaudichaudii</i>

REFERENCES

- ENDLICHER, S. L. 1837. Bemerkungen über die Flora der Südeinseln. *Wien Mus. der Naturgeschichte*, Ann. 1: 129–190, 16 pls.
- GAUDICHAUD, C. 1826–1830. *Voyage autour du monde entrepris par ordre du Roi . . . sur les corvettes l'Uranie et la Physicienne pendant les années 1817, 1818, 1819, et 1820 . . . par M. Louis de Freycinet*. Botanique, vii + 522 pp. Atlas, 120 pls. Pillet aîné, Paris.
- 1846–1849. *Voyage autour du monde exécuté pendant les années 1836 et 1837 sur la corvette la Bonite commandée par M. Vaillant . . . Botanique, cryptogames cellulaires et vasculaires*. Atlas, 150 pls. Arthus Bertrand, Paris.
- HILLEBRAND, W. 1888. *Flora of the Hawaiian Islands. A description of their phanerogams and vascular cryptogams*. xcvi + 673 pp., 1 pl., 4 maps. Williams & Norgate, London. B. Westermann & Co., New York.
- HOOKE, W. J. and G. A. W. ARNOTT. 1830–1841. *The botany of Captain Beechey's voyage comprising an account of the plants collected by Messrs. Lay and Collie, and other officers of the expedition during the voyage to the Pacific and Bering's Straits, performed in His Majesty's ship, Blossom, under the command of Captain F. W. Beechey . . . in the years 1825, 26, 27, and 28*. ii + 485 pp., 99 pls. Treuttel & Würtz, Treuttel, Jun., & Richter, London.

- LANJOW, J. 1939-1941. On the standardization of herbarium abbreviations. *Chronica Botanica* 5: 142-150; [Additions] 6: 377.
- MEYEN, F. J. F. 1834-1835. *Reise um die Erde ausgeführt auf dem Königlich Preussischen Seehandlungs-Schiffe Prinzess Louise commandirt von Capitain W. Wendt in den Jahren 1830, 1831, und 1832.* v. 2. vi + 411 pp., 1 map. C. W. Eichhoff, Berlin.
- 1843. *Observationes botanicas in itinere circum terram institutas. Beiträge zur Botanik, gesammelt auf einer Reise um die Erde.* Nova Acta Acad. Leop.-Carol. Nat. Cur. 19. Suppl. 1. xxxii + 512 pp., 13 pls. Halle.
- SKOTTSBERG, C. 1944. Vascular plants from the Hawaiian Islands. IV. Phanerogams collected during the Hawaiian bog survey 1938. *Horti Gotoburgensis, Acta* 15: 275-531, 556 figs.
- STEUDEL, E. T. 1840-1841. *Nomenclator botanicus, seu: synonymia plantarum universalis, enumerans ordine alphabetico nomina atque synonymia, tum generica tum specifica, et a Linnaeo et a recentioribus de re botanica scriptoribus plantis phanerogamis imposita.* Editio secunda ex nova elaborata et aucta. Pars II. 810 pp. J. G. Cottae, Stuttgartiae et Tubingae.
- WAWRA, H. 1872-1875. Beitrag zur Flora der Hawai'schen Inseln. *Flora* 57: 545-549.
- WEDDELL, H. A. 1856-1857. Monographie de la famille des Urticées. *Paris Mus. d'Hist. Nat., Nouvelle Arch.* 9: 1-592, 20 pls.
- 1869. Urticaceae. 16(1): 32-235⁶⁴. In: De Candolle, A.P., A., and C., ed., *Prodromus systematis naturalis regni vegetabilis.* . . . 17 v., 1824-1873. G. Masson, Paris.